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THE PHILIPPINE AGRICULTURIST

UNIVERSITY OF THE PHILIPPINES PUBLICATIONS SERIES A

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The Philippine Agriculturist

(University of the Philippines Publications Series A)

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THE AGRICULTURAL COLLEGE—ITS OPPORTUNITY FOR SERVICE [1]

LELAND E. CALL [2]

It was with pleasure that I accepted Dean Uichanco's invitation to speak briefly on this occasion. It serves to commemorate the assistance that the institution has received toward its rehabilitation. It carries forward the faith of those farsighted agricultural educational leaders—Copeland, Baker, Roxas, Gonzales and others—who had visions of what this institution should be and who laid the foundation upon which the institution was built. They started with a cogon-grass waste sloping up from Laguna de Bay to the foothills of Mount Maquiling. They developed a campus that became a spot of beauty as well as a well-equipped institution of higher learning recognized for its superior agricultural research and education throughout the Far East.

Such an auspicious beginning was to be followed, unfortunately, by the almost complete destruction of the institution during the Japanese occupation when nearly all buildings were destroyed. The library was burned, equipment and livestock were lost, and many outstanding members of the faculty with their families murdered. At the end of the war, the campus was a shambles. The only assets remaining were the natural beauty of the campus and the faith of the faculty who felt that the institution could be restored.

This faith has been sustained in part by assistance given by the United States Army in the reconstruction of a few minor buildings and a grant of $470,000 from the United States War Damage funds with which a few buildings were reconstructed. It was not, however, until the PHILCUSA-FOA aid became available in 1951 that substantial progress could be made in the restoration of the College.

This financial aid has consisted of about 1½ million American dollars and over 6 million pesos of counterpart and appropriated funds. This aid constructed the library building that we are dedicating today, eight other major buildings, and many other structures. Laboratories for instruction and research have been equipped; houses provided for local and visiting faculty members; a power plant built; a water system started; valuable books, journals and periodicals for the library purchased. In addition, provision has been made for one of the leading Land Grant Colleges of the United States—Cornell University—to send from ten to fourteen visiting professors to assist

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[1] Miscellaneous Contribution No. 30. Address delivered at the dedication of the Library, College of Agriculture, University of the Philippines, Los Baños, March 3, 1955.

[2] Agricultural Research Advisor of the FOA Mission to the Philippines.

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in the reconstruction of the college, to encourage more intensive research, and to aid in making plans for the future development of the institution. The Cornell advice is scheduled over a period of 5 years. Important as this contribution of financial aid has been in the reconstruction and re-equipping of the College, it is less important than the spiritual aid that has served to strengthen the morale of the faculty and student body and to provide the faith upon which strong institutions develop.

This faith can be justified only if the people of the Philippines and their Congress see to it that funds are provided in the future to carry forward the excellent beginning that has been made. Substantial amounts of pesos will be required in gradually increasing amounts to maintain and expand the work of the institution. Funds provided for this purpose should not be considered as expenditures but rather as investments. When properly utilized, appropriations for this college return in the form of increased national wealth many times the amount invested. An increase in the annual production of palay of one cavan a hectare for the Philippines, easily made possible through the plant breeding work of the Experiment Station, will provide five times the increase in wealth necessary for the support of both the College and the Station.

Every enlightened country of the world has found that money invested in agricultural education and research returns in increased wealth many times more than the amount invested. Much of the economic progress that has occurred in America in the past 50 years is the indirect result of money that was invested in agricultural education and research. The knowledge gained from these investments has enabled one person working on a farm in America to feed and clothe himself and 17 other persons. The development of hybrid corn alone has increased corn yields 50 per cent since 1935 and repaid the total investment in agricultural research through the entire life of the United States. It is inconceivable that a country as progressive as the Philippines, that has provided a general educational system that is outstanding in Far East Asia, would fail to make the investment adequate to maintain a strong agricultural college and experiment station.

The College itself has a continuing responsibility to keep the public and its elected representatives informed of its achievements and its requirements. The College administrators cannot retire to academic isolation and trust that their good works will be fully recognized and rewarded. As stewards of a public investment, these administrators have a duty to report their stewardship to the public.

THE LIBRARY

It is most fitting that the library should be chosen for these dedicatorial exercises. The library is the center of a strong educational institution. It is the depository of the recordings of mankind's accomplishments through the ages. It can serve as an incentive for

the accomplishments of youth and is an indispensable educational facility.

The library is the starting point for all well-planned research. It is here that the researcher turns for information as to what others have done in the solution of the problem to be undertaken. It is only after a thorough search of the literature that the researcher is ready to outline his research project. A research worker must have the facilities of a library containing well-indexed journals and other publications that record past accomplishments pertaining to the problem under consideration. Otherwise, he will be handicapped seriously and may undertake work to find information already known but not available to him because a good library was not at his disposal.

In addition to providing an important working tool for the researcher, the library should provide the reference material needed for good instruction. In the Philippines, publishers are unable financially to publish texts adapted to local agricultural conditions. A good working library here should possess a sufficient number of each reference book to enable reading assignments to be completed on time by each student. A good library will also contain a reasonable number of books for cultural and recreational reading. The number of such books should be larger in an agricultural college located at a distance from the university than when located on the main campus where the facilities of the central university library are available to agricultural students.

The College, before its destruction by the Japanese, had a library of 20,000 volumes made up of those books and journals most useful for agricultural research and instruction. Many of these old volumes that were destroyed are no longer available for replacement. However, a creditable job of re-equipping the library has been done. A good working library of over 11,000 volumes has been assembled. Such useful volumes as were available within the means of the institution have been purchased. The library is still lacking much needed reference material and it has not been possible to supply the number of duplicate copies needed for student reference reading. Neither has it been possible to provide the books for cultural and recreational reading that should be available in a good library located on an independent college campus.

OPPORTUNITIES FOR SERVICE

The opportunities for an agricultural college to serve lie primarily in three major fields:

(1) in the training of youth for leadership;
(2) in discovering new facts useful to farmers and society;
(3) in disseminating facts to make them available to farmers and the general public.

TRAINING FOR LEADERSHIP

The Agricultural College should be expected to provide advanced education in agriculture to a sufficient number of outstanding young men and women to assure that agricultural development goes forward and that the political, social and economic welfare of rural people will be safeguarded.

How many such potential leaders should be trained? In what capacities should they serve?

Several types of agricultural leaders are needed. Most essential are educated farmers living on the land not engaged in governmental work or under obligation to any political organization. They should know farm problems at first hand, be able to speak for farmers and their families, and be able to make their voice heard at provincial and national governmental centers. It would be desirable to have a maximum number of such individuals, but the number of those possessing the qualities required for such leadership is small. America feels there should be as many well-educated leaders of this character living on farms in a position to voice the needs of agriculture as there are well-educated city dwellers in a position to express urban needs. The Agricultural College should provide training for this kind of rural leadership. In America, however, many such leaders have received their training in other types of institutions of higher learning, but have relied upon the agricultural colleges to provide the technical advice that was needed to make their efforts effective.

A second type of leadership that is needed is well-trained technical workers to staff Government agencies serving agriculture. It was primarily to provide training for such individuals that the agricultural colleges were established. Such workers need to have broad training in agriculture with intensive technical training in their particular fields of specialization. Workers technically trained in this manner are needed to provide the technical staffs for agricultural entities of the government such as the Bureau of Agricultural Extension, the several technical bureaus of the Department of Agriculture and Natural Resources, the Agricultural Credit and Cooperative Financing Administration (ACCFA), the Agricultural Tenancy Commission, the College of Agriculture itself, and the vocational agricultural schools.

In the past years, the training of such workers has been largely in the fields of the physical and biological sciences (physics, chemistry, botany, zoology, entomology) with their application to engineering, the plant and animal sciences, and homemaking. Such training serves satisfactorily as a basis for work with the problems of improving agricultural production. There are other needs today. Agriculture in the Philippines today has three outstanding needs and technical knowledge of improved production practices is but one of them. The two other great needs are (1) how to get more control of marketing farm products in the hands of farm families, and

(2) how to get better conditions of tenure for people living on the land. I do not wish to depreciate the importance of the type of training that has been stressed by the Agricultural College in the past. Instead, I wish to expand the opportunities for training in social and economic sciences in order that a supply of well-trained technical workers will be available for ACCFA, the Agricultural Tenancy Commission, and other agencies requiring workers trained in the social sciences. In addition, persons whose training is primarily in the physical and biological sciences should get insight into the social sciences to understand the relationship of their work to the social and economic problems affecting the welfare of rural people.

Another need is for well-trained technical workers in agriculture to serve private organizations outside the government engaged in rural work. Such entities include agricultural cooperative associations, farmers irrigation associations, machinery distribution companies, fertilizer distributing companies, banks, privately sponsored movements like the Philippine Rural Reconstruction Movement, civic clubs, and religious missions. People working in private groups outside of the government usually can do things in local communities more quickly and more economically than is possible only through government agencies. The character of the training provided for this group need not differ materially from training offered other technically trained workers.

RESEARCH

In the rehabilitation of the College and the contract with Cornell University, special attention has been given to provide facilities to conduct research. A well-developed research program at the College of Agriculture is highly essential for two reasons:

First, an educational institution in agriculture will not remain long an institution of high standing unless there is opportunity for research upon the part of the faculty. Under an ideal situation, each teacher is able to participate in some research and each researcher to do some teaching. It was upon this basis that the Central Experiment Station of the College was staffed three years ago. Since then it has been necessary to change the procedure and set up a few full-time research positions. This was made necessary due to the heavy teaching load resulting from an increase in the student body from 851 students in 1952 to 2700 students this year. Thirty-six full-time research positions have been established. This arrangement of a few full-time research workers makes certain that a staff of researchers is available to carry forward without interruption the important work of the Experiment Station. While reasonably satisfactory from the research standpoint, the arrangement does not give an opportunity for all teachers to do some research. This condition cannot be corrected until a larger teaching staff can be provided.

A second and far more important reason for research is the urgent need of the Philippines for actual information pertaining to the problems of agriculture. Improved agricultural practices are being delayed and programs of action are being held back for lack of factual information. A few urgent problems in need of solution are

(1) How to increase the production of food crops to guarantee self-sufficiency in view of the rapid increase in population;

(2) How to use undeveloped resources of the country in ways that will assure improved nutritional and living conditions;

(3) How to protect the export products of the country from the dangers of abacá mosaic disease, cadang-cadang disease of coconut, and high production costs in the sugar industry;

(4) How to provide economic information for those agencies engaged in improving social conditions in the country, and,

(5) Finally, how to increase the productive ability of the Filipino farmer and farm worker in order that farm families and the country as a whole may enjoy a higher standard of living.

These are but a few of the many problems regarding which factual information is highly essential. Well-supported research at the College will help in the solution of these and other problems. The results will return in improved income and well-being many times the cost of the investment.

The popular image of a research worker is a hermit working alone in a sheltered laboratory out of contact with other people. If this condition ever existed, it was true only in the early days of research when the problems under study were simple and when the knowledge available to one man was more nearly adequate than today. The problems of research today are so complicated that little can be accomplished by a lone scientist working in isolation. Research in agriculture is most successful when conducted in an educational institution with a staff of many specializations, where the staff undertakes each problem in a cooperative manner so that the thinking of many specialists can be directed to the solution.

Take for example the problem of producing a superior variety of rice. This is not simply a job for a plant breeder. The new variety must meet all agronomic requirements; it must be acceptable from a nutritional and personal preference standpoint; it must meet the marketing demands, both domestic and foreign. Thus the plant breeder in his work should have the close cooperation of other specialists such as the entomologist, the plant pathologist, the chemist, the soil technician, the agronomist, the human nutritionist, and the economist. Most other agricultural problems require the same kind of cooperative attack for their successful solution.

Agricultural research in the Philippines is the responsibility both of the College and of the Department of Agriculture and Natural Resources. Substantial progress is being made to coordinate

the work of these two agencies to make their work cooperative—not competitive. The two agencies are combining their efforts for the solution of many perplexing agricultural problems. Conferences are held to plan a joint attack; then formal memorandums of understanding are drawn up and signed by each agency, designating work to be undertaken by each.

Such formal memorandums are now in effect covering work in rice and corn improvements, pump irrigation, animal breeding, production and distribution of disease-resistant abacá plants, and forage crop production. Cooperation of a less formal character exists for such problems as cadang-cadang disease of coconuts, coffee and cacao production, weed and insect control, vegetable production, fertilizer studies, the economic experiences of settlers in Mindanao, and the living costs and conditions of families in the rice area of central Luzon. Work that is conducted cooperatively in this manner will be more productive than work undertaken independently. It has the added advantage of making the best use of the equipment and personnel available for research.

EXTENSION

Ralph Waldo Emerson has said that if a man is successful in making a better mousetrap, the public will beat a path to his door. This may be true after the superior quality of the mousetrap had been demonstrated and the public has seen dead rats in the trap. But it is not true until the public is convinced of the superior qualities of the mousetrap. The same condition applies to new facts discovered through research. Farmers the world over are suspicious people of new and strange things. A new fact will not be accepted and tried by farmers until they are convinced through demonstrations that it will really help them.

New facts discovered through research are of little use as long as they are locked in the minds of the researcher or are buried in a technical journal on the shelves of a library. An agricultural college therefore does not fulfill its responsibility by discovering a new fact and publishing that fact in a technical journal. The institution has the added responsibility of seeing that steps are taken to demonstrate the new fact to the people who can apply it with profit. Accordingly, an agricultural college must have access to facilities to reach not only technical workers through scientific journals but farm families on the land through popular publications and demonstrations.

The College should maintain a close relationship with the Bureau of Agricultural Extension to see that new facts reach farmers promptly through the Extension Service. Moreover, the College should help with the in-service training of extension workers and the education of farm families through cooperative courses. The short courses and field days that have been conducted cooperatively on this

campus by the College and Extension should be continued and expanded so the College may fulfill its extension responsibilities.

In closing, I wish to repeat that the opportunity for an agricultural college for service is in three distinct fields: (1) in the training of youth in the technical aspects of agriculture and homemaking; (2) in the search for new facts essential to improved agriculture and homemaking, and (3) in seeing that new facts are made available promptly to the general public. In order to perform these functions well, the institution must be supported adequately. Such support should not be considered as an expense but as an investment that will return dividends in economic and social welfare far in excess of the investment made. If adequately supported, the College of Agriculture of the University of the Philippines will continue to be of inestimable value to the Philippines and may become the outstanding institution of learning in agriculture for all southeast Asia.

ONWARD TO PROGRESS [1]

Cornelio V. Crucillo [2]

This imposing new Library building which we are inaugurating today, together with 32 other new structures constructed on this campus during the last three years or so, constitutes a mute but eloquent evidence of the capacity of dedicated men to triumph over the forces of adversity.

But for the spirit and courage of such dedicated men, this college might well have remained the ugly mass of ruins to which it had been reduced by the last destructive war. For on the day of liberation there was practically nothing left of this college save the telltale evidence of ruthless enemy occupation, the scars of war, and the flickering sparks of bitter-sweet memory reminiscent of its glorious past and tragic experience. Its buildings had been gutted by fire, roads and bridges blasted, tools and equipment destroyed or lost, and accumulated achievements of years of scientific work including breeds of animals, crop cultures, museum specimens, rare plants, valuable books and publications lost.

When it resumed operation in 1954, it was not very much better off in terms of facilities than it was during the year of its founding 46 years ago. The climb upward was a painfully slow process and was only made possible through the sacrifices and perseverance of the man at the steering wheel—the redoubtable Dean Uichanco, whose miraculous survival from the series of brutalities and massacres committed in this area may well be considered an act of providence—he and other members of the faculty similarly spared, perhaps by heavenly design, so that they may continue serving the College in the same tradition that has brought honor and renown to this institution—tradition of courage, of loyalty of unflinching devotion to duty, no matter at what personal sacrifices.

However, even with its meager facilities the importance of the work of this institution has not been lost to those who understand fully its mission. In fact its shortcomings actually served to accentuate that recognition.

So it was that when an Economic Survey Mission, known as the Bell Mission, visited this country in 1950 the vital role of this college as an educational institution and its possibilities as a center of agricultural research essential to our economic development were brought to the focus of public attention in the most emphatic terms.

From here on, it is relatively easy to understand why at the inception of the Joint Development Program in this country pur-

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[1] Miscellaneous Contribution No. 31. Presentation address delivered at the inauguration of the Library Building, College of Agriculture, Los Baños, Laguna, March 3, 1955.

[2] Executive Secretary, PHILCUSA.

suant to the Bilateral Agreement between the Government of the United States and the Government of the Philippines in 1951, the rehabilitation of the College of Agriculture and establishment of a Central Experiment Station was among the very first projects given top priority. This project is premised on these primary considerations:

1. The gradual rehabilitation and development of the College of Agriculture shall be continued in order to enable that institution to take care properly of increased enrollment and produce graduates of adequate number and quality to meet the growing needs of the country.

2. The College of Agriculture is to be provided with the necessary laboratory and field equipment so it can function as a Central Experiment Station for agricultural research, particularly on fundamental problems, essential to the scientific development of Philippine agricultural industries. Results of this research program will serve as a basis of improvement of farm methods, plant materials used by farmers, and also as material for instructional and educational purposes.

An evaluation of the progress attained in the implementation of this project attests to a successful realization of these objectives. The buildings and plants have been completed; the laboratories, the library, the classrooms, and the infirmary have been fully equipped; roads built; communication, health and instructional facilities highly improved. As a result of all these accomplishments enrollment has increased by 152% in two years since 1952 when the project began to take concrete form. A program of expanded and intensified agricultural research has been set in motion; a total of 220 researches has been completed while 273 others are now in progress.

As of January 1, 1955, this project has received commodities and technical assistance amounting to $685,523.13 and a counterpart fund aid of ₱2,653,878.98. This FOA-PHILCUSA assistance has served as a lever for elevating the instruction and research potential of this institution and for securing for it a proportional increase in the regular budgetary appropriations. The realization of the objectives set forth in the Guiding Principles agreed upon by PHILCUSA and the College of Agriculture are indications of efficient and smooth implementation of the project.

The main tasks, however, assigned to this institution do not end here. In fact they have just begun. The challenge that confronts the faculty, the research staff and the graduates of the College of Agriculture in promoting agricultural progress is the bigger task to perform. The capacity of this institution to mould and turn out adequately trained graduates fully prepared to contribute efficiently in the direction and prosecution of our program of development will be the measure of the true worth and success of this project.

At this stage of development of the College of Agriculture and Central Experiment Station all of us from the PHILCUSA, FOA Mission, College of Agriculture and other offices who have in some way participated in pushing through this project feel:

(1) that we have kept faith with the ideals of this institution preserved by those who have nurtured it through the years in the firm conviction that it is an indispensable instrument for moulding the youth to that pattern of thought and action considered paramount in an underdeveloped country, predominantly agricultural, that is the Philippines;

(2) that this activity is a projection of the vision of its founder, Dr. Edwin Bingham Copeland, an American citizen who recognized from the start that research in agriculture is a prerequisite to the scientific and efficient development of our agricultural industries;

(3) that the project is an investment in wisdom and foresight which takes into consideration the crucial problems and needs of the country in the furtherance of its economic well-being through a dynamic, well-informed, properly guided rural population with the right attitude of mind and deeply rooted to the soil which produces our basic needs;

(4) that it is an investment which cannot fail to produce rich dividends in the course of our perpetual struggle for social, political and economic stability and for the preservation of the way of life we treasure dearly under our democratic institutions.

Mr. President, in the name of PHILCUSA, I feel deeply honored in turning over to the University of the Philippines, through you, this new Library building and the 32 other buildings together with the accessories that go with them, constructed in, or provided to, the College of Agriculture and the Central Experiment Station under the joint auspices of the PHILCUSA and the FOA Mission. Accompanying this formal turnover is a fervent prayer that these facilities will be used fully and in such a manner as to redound to the maximum benefit of all of us of this generation and of the generations yet to come.

THE INFLUENCE OF 5 AND 10 PARTS IPIL-IPIL LEAF MEAL IN THE COLLEGE LAYING RATION [1]

José R. Sandoval

WITH TWO TEXT FIGURES

The addition of ipil-ipil (*Leucaena glauca* Linn.) leaf meal in the College all-mash ration did not increase egg production, but it promoted growth. Increased ipil-ipil leaf meal intensified the color of the yolk but had no effect on the weight of the eggs. In general, no advantage can be derived from adding ipil-ipil leaf meal to the College laying ration.

Ipil-ipil leaf meal is a locally produced feed that is now gaining popularity among local poultry raisers because it is believed to contain a good amount of vitamins needed by birds to carry on their body and egg-laying functions.

Molina [2] reported that the addition of ipil-ipil leaf meal to the College all-mash ration for growing chicks induced a better rate of growth and a consistently low mortality. Fronda and Dingayan [3] reported similar results with green ipil-ipil leaves and shoots in rations for growing chicks.

To find out if the College standard laying mash may be improved by the addition of ipil-ipil leaf meal, this study was undertaken in the Department of Animal Husbandry from August, 1952, to July, 1953.

MATERIALS AND METHODS

Sixty selected S.C. White Leghorn pullets of the College stock which were more or less of the same age and weight were divided at random into three lots of 20 birds each. All the birds in the different lots were legbanded and weighed and then kept in individual laying cages inside the poultry building.

The basal ration was the College standard laying mash which is made up of the following ingredients, all parts by weight: ground yellow corn, 50 parts; rice bran, 20 parts; fish meal, 20 parts; copra meal, 20 parts. The birds in lot I were given the basal ration; those in lot II, the basal ration plus 5 parts ipil-ipil leaf meal;[4] and those

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[1] Central Experiment Station Contribution No. 1813. Thesis presented for graduation with the degree of Bachelor of Science in Agriculture from the College of Agriculture, October, 1954. Prepared in the Department of Animal Husbandry under the direction of Instructor Amado C. Campos.

[2] D. G. Molina, *Philippine Agriculturist*, 37, 142 (1953).

[3] F. M. Fronda and A. A. Dingayan, *Philippine Agriculturist*, 34, 110 (1950).

[4] The ipil-ipil leaves were gathered from the locality and were dried and ground. The analysis of the leaves was as follows: moisture, 9.07; crude protein (N × 6.25), 20.78; crude fats (ether extracts), 6.38; carbohydrates (N.F.E.), 3952; calorific value/100 grams, 299.00; crude fiber, 12.57; and ash, 11.68. All figures are expressed in per cent and were taken from Molina's study.

in lot III, the basal ration plus 10 parts of ipil-ipil leaf meal. Five kilograms of ground shells and grit and 1 pint of cod liver oil were added to every 100 kilograms of the mash. Water was made available to the birds at all times. All efforts were made to give the same care and management to the lots.

The monthly weight and egg production of each bird, as well as the weights of the first 10 eggs laid by each bird every month, were taken down. Likewise, the monthly feed consumption of each of the three lots was recorded. Samples of eggs from each lot were taken at random and their yolks compared for intensity. The mortality in each lot was also noted.

DISCUSSION OF RESULTS

Weight of the birds. The birds in lot II were only 16 grams heavier than those in lot I and 17 grams heavier than those in lot III (table 1). Since the pullets were not yet fully grown when the study started, all the birds in the three lots were expected to put on additional weight during the experiment, but the lot I pullets exhibited marked decreases in weight except from November to February. This decrease may have been due to ascariasis which infested all the lots and which caused the death of many of the birds. The birds in lots II and III, on the other hand, showed noticeable increases in weight during the first half of the observation period when the days were cooler and they were still growing, but they tended to drop back to their original weights during the later part of the study when the weather was hot and appetites were depressed. An analysis of the monthly weights of the birds in all the lots (fig. 1) showed significant differences. This finding corroborates that of Fronda and Dingayan.[5]

With the mean of the 12 monthly average weights of the birds in the lots as a gauge of the effect of the ration on the body weight, the ration with 5 parts ipil-ipil leaf meal may be considered the best of the three rations; the one with 10 parts ipil-ipil leaf meal, second; and the unsupplemented ration, the poorest. The differences in body weight between the birds given supplemented rations (lots II and III) and those given the unsupplemented ration (lot I) were significant. This observation is contrary to the findings of Quisenberry,[6] Burgos and Martin,[7] and Gapuz.[8]

Egg production. At the start, lot I had the highest percentage of egg production, followed by lot II and lot III (table 2). At the end of the experiment, lot I still led in egg production, lot III was second, and lot II was third. The figures indicate that the substi-

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[5] Fronda and Dingayan, *op. cit.*

[6] J. H. Quisenberry, *Hawaii Agric. Exper. Sta. Rept.*, 131 (1944-1946). Cited in *Poultry Sci.*, 27, 558 (1948).

[7] Carlos X. Burgos and Rufino Martin, *Philippine Bur. Anim. Indus. Recorder*, [3] 12, 27 (1950).

[8] H. B. Gapuz, *Poultry Messenger*, [2] 15 (1951).

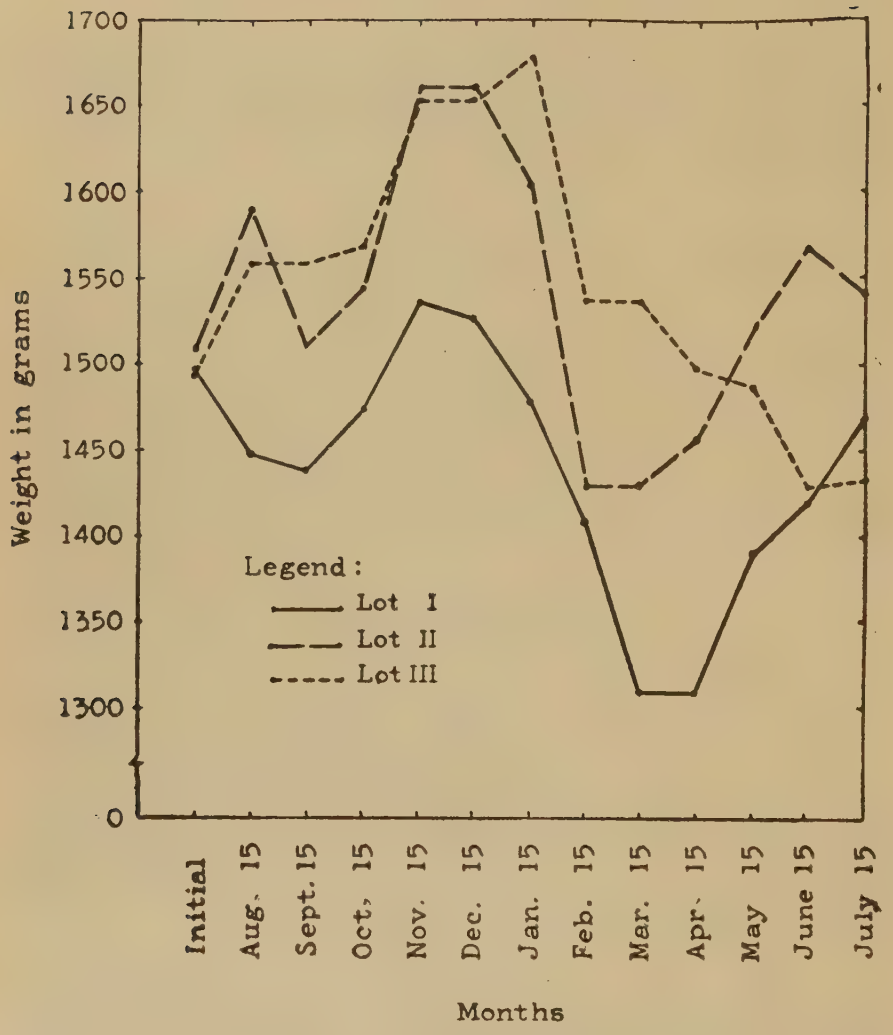

Fig. 1.—Average initial and monthly weights in grams of pullets in the three lots.

tution of 5 and 10 parts of the College laying ration with ipil-ipil leaf meal affected adversely the egg production of the S.C. White Leghorn pullets.

Weight of the eggs. There were no marked differences in the size of the eggs produced by the pullets from the different lots (table 3). The size of the eggs increased during the later part of the laying period, but the monthly differences in weight were insignificant (fig. 2).

Amount and cost of feed consumed. The differences in the amount of feed consumed by the birds in the three lots (table 4) may be attributed to the fact that the lot I birds were heavy layers and therefore needed more feed. To get the needed nutrients for egg production, lot III consumed more feed than lot I because the lot III birds had to take, in addition to ipil-ipil leaf meal, as much basal ration as those in lot I. Lot II, which consumed the least feed, produced the least number of eggs.

Mortality. Of the 20 birds in each lot, 7 died in lot I, 5 in lot II, and 8 in lot III (table 5). One bird in lot I died of a cystic ovary; two in lot II, of egg peritonitis; and the rest, from undetermined causes.

Minor observations. The greater the amount of ipil-ipil leaf meal added to the basal ration, the more intense was the yolk color of the eggs. Pang [9] likewise found that birds which consumed more green feeds produced eggs with deep-colored yolks.

[9] R. Pang, *Philippine Agriculturist*, 37, 317 (1953).

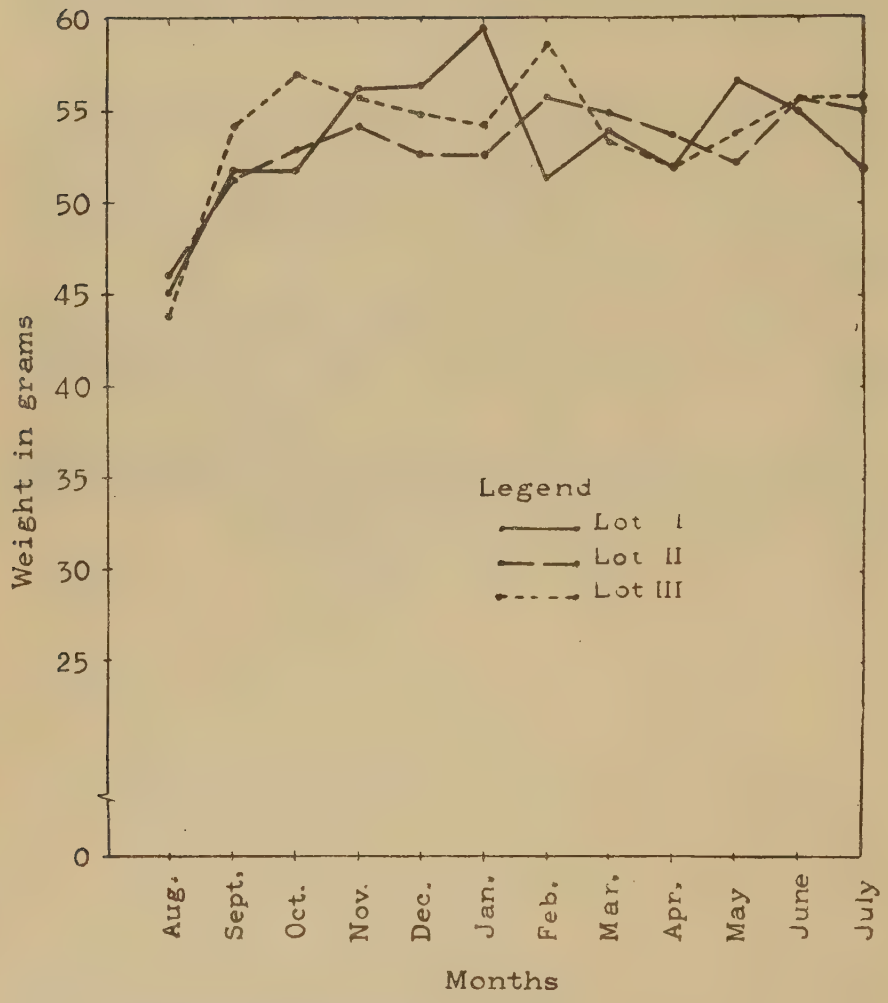

Fig. 2.—Average weights of first 10 eggs laid by each bird every month.

TABLE 1.—*Average initial and monthly weights in grams of pullets in the three lots*

LOT	INITIAL WEIGHT	MONTHLY WEIGHT IN GRAMS												TOTAL	MEAN
		Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	March	April	May	June	July		
I	1493.39	1409.84	1407.07	1475.53	1538.76	1519.23	1545.53	1477.61	1407.84	1306.96	1306.96	1398.15	1470.92	18757.79	1442.91
II	1509.40	1599.66	1509.66	1549.40	1664.53	1658.53	1605.13	1431.00	1431.00	1457.33	1519.60	1569.93	1541.73	20046.90	1542.07
III	1492.35	1557.61	1558.92	1575.48	1651.00	1653.15	1685.53	1531.84	1531.84	1458.53	1488.15	1399.46	1425.61	20009.47	1539.19
Total	4495.14	4567.11	4475.65	4600.41	4854.29	4830.91	4836.19	4440.45	4370.68	4222.82	4314.71	4367.54	4438.26	58814.16	

Analysis of variance

SOURCE OF VARIANCE	DF	SUM OF SQUARES	MEAN SQUARE	COMPUTED F-VALUE	TABULAR F-VALUE	
					5%	1%
Month	12	169481.80	14,121.48	4.97	2.18	3.03
Lot	2	82811.50	41,405.75	14.57	3.40	5.61
Month × Lot	24	68191.51	2,841.31			
Total	38	320484.81				

L.S.M.D. for lot = 44.91
L.S.M.D. for month = 89.83

TABLE 2.—*Distribution of egg production in the three lots*

MONTH	PERCENTAGE PRODUCTION		
	I	II	III
August (1952)	59.3	47.0	43.0
September	58.4	56.0	42.3
October	49.5	47.2	50.0
November	63.0	51.2	40.1
December	59.7	45.6	54.5
January (1953)	68.5	62.0	67.8
February	59.2	66.7	60.9
March	62.0	53.3	50.5
April	47.5	46.7	49.6
May	51.4	46.7	52.0
June	50.5	46.9	55.6
July	44.9	43.9	60.0
Total production for the year	3450	3023	3322
Annual production of each bird	212.8	173.6	194.7
Annual percentage production	58.2	47.7	53.5

TABLE 3.—*Average weights of first 10 eggs laid by each bird every month*

LOT	MONTHLY WEIGHT IN GRAMS												TOTAL WEIGHT	MEAN
	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	March	April	May	June	July		
I	46.0	51.8	51.7	56.0	56.0	58.5	51.1	54.0	51.9	58.5	57.0	52.9	645.4	53.8
II	46.6	51.4	52.8	54.2	52.6	52.6	56.6	55.1	54.4	55.2	57.5	55.0	644.0	53.7
III	43.8	49.0	53.8	54.5	58.0	54.5	58.5	53.3	54.5	55.9	57.6	56.1	649.5	64.1
Total	136.4	152.2	158.3	164.7	166.6	165.6	166.2	162.4	160.8	169.6	172.1	164.0	1,938.9	

Analysis of variance

SOURCE OF VARIANCE	DF	SUM OF SQUARES	MEAN SQUARE	COMPUTED F-VALUE	TABULAR F-VALUE	
					5%	1%
Month	11	329.11	29.92	7.18	2.26	3.18
Lot	2	1.36	0.68	0.16	3.44	5.72
Month × Lot	22	91.76	4.17			
Total	35	422.23				

L.S.M.D. = 3.44

TABLE 4.—*Amount and cost of feed consumed*

ITEM	LOT		
	I	II	III
Amount of feed consumed, kilograms	567.2	556.5	563.6
Cost of feed consumed, pesos [a]	179.36	169.31	170.77
Average consumption of one bird during the year, kilograms	34.8	51.9	33.0
Amount of feed needed to produce a dozen eggs, kilograms	2.97	2.21	2.04
Cost of feed needed to produce a dozen eggs, pesos	0.99	0.67	0.62

[a]Computed at ₱0.30 a kilogram for lot I, ₱0.308 for lot II, and ₱0.303 for lot III. The supplemented ration cost more than the unsupplemented one because a kilogram of the ipil-ipil leaf meal cost more than the same weight of the basal ration.

TABLE 5.—*Rate of mortality*

ITEM	LOT		
	I	II	III
Number of birds at the start	20	20	20
Number of birds at the end of the experiment	13	15	12
Number of birds that died	7	5	8
Percentage of mortality	35	25	40

HELMINTHOSPORIUM LEAF SPOT OF KAPOK[1]

FAUSTINO T. ORILLO AND PATRICIO B. ROMANO

Helminthosporium leaf spot of kapok (*Ceiba pentandra* [Linn.] Gaertn.), hitherto not reported from other countries where this fiber plant is grown, causes premature defoliation. The disease produces on the leaves circular yellow spots with dull green-yellow borders which turn to amber yellow as the lesions become older. In the advanced stage of the disease the spots become dark grayish brown and the adjacent lesions may coalesce to form large, irregular, blackish-brown patches.

The disease is caused by *Helminthosporium ceibae* Orillo. The fungus grows on potato-dextrose agar, kapok decoction agar, onion agar, corn meal agar, nutrient dextrose agar, nutrient agar, and malt agar, but it does not sporulate on any of these media.

The conidia of the fungus may remain viable for one month on the diseased leaves and may be disseminated by rain and wind. The disease may be controlled by sanitation, selection, and disinfection of the seeds for planting.

Kapok or silk cotton is one of the fiber plants grown in the Philippines, particularly in the Visayas. It is a medium-sized tree with deciduous, digitately compound leaves. The fiber which comes from the silky hairs of the seeds is used for stuffing cushions, pillows, and mattresses and in the manufacture of life jackets and life belts.

The plant is relatively free from diseases except for leaf spot. An attack of leaf spot is often followed by defoliation. Since the disease has not yet been studied in detail in the Philippines, this investigation was conducted from December, 1952, to October, 1954, in the Departments of Agronomy and Plant Pathology to find out the cause of leaf spot and the measures for its control.

THE DISEASE

No record of the occurrence of the Helminthosporium leaf spot of kapok in other countries is known. Its presence in the Philippines was reported for the first time by Orillo.[2] The disease often occurs on seedlings in the College of Agriculture in varying degrees of severity.

The disease is manifested by circular yellow spots on any part of the lamina of the leaves. The borders are dull green-yellow, which turns to amber yellow as the lesions become older. The spots vary in size, the majority attaining a diameter of 5 millimeters.

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[1] Central Experiment Station Contribution No. 1814. Based on the thesis presented by the junior author for graduation with the degree of Bachelor of Science in Agriculture from the College of Agriculture. Prepared in the Department of Plant Pathology under the direction of the senior author.

[2] F. T. Orillo, *Philippine Agriculturist*, 38, 548 (1955).

As the lesions enlarge, the central portion changes to dark grayish brown owing to the production of conidia and conidiophores of the causal fungus.

In the advanced stage of the disease, adjacent lesions may coalesce and form large, irregular, blackish-brown patches. Observations in the field showed that the spots are more conspicuous and abundant on the older lower leaves than on the younger upper leaves. In the final stage of the disease, the affected portions form confluent patches of dead tissues and cause premature death of the leaves, followed by defoliation of the plants.

CAUSAL ORGANISM

The tissue-plating and single spore methods of isolation were employed. The culture media used were potato-dextrose agar, kapok decoction agar, corn meal agar, Czapek's agar, and oatmeal agar. The fungus grew on all of these media but did not produce conidia.

Morphology

Mycelium. The hyphae are finely granular and subhyaline when young, but they turn pale brown with age. Measurements of 100 hyphal cells taken from a 15-day-old culture show that the cells vary from 13.0 to 58.9 $\times$ 3.4 to 5.1 μ. The average size of the hyphal cells is 34.66 $\pm$ 1.14 $\times$ 3.55 $\pm$ 0.90 μ (table 1).

Conidiophores. The conidiophores are produced in abundance on the upper surface of the affected leaves. They arise in groups of two to five and are light brown in color, becoming lighter toward the apices. They are 5- to 12-septate, the majority being 8- to 10-septate. Measurements of 200 conidiophores vary from 197.2 to 222.9 μ in length and from 3.4 to 8.5 μ in width (table 2). The length of the conidiophores varies considerably, but the width varies slightly. The average size of the conidiophores is 205.15 $\pm$ 0.93 $\times$ 6.94 $\pm$ 0.88 μ. Most of the conidiophores fall within the length classes from 197.0 to 212.9 μ and within the width classes from 5.0 to 6.9 μ. The majority have a length-to-width ratio ranging from 29.0 to 32.99 (table 3).

Conidia. The conidia are borne singly at the tip of the conidiophores. They are 4- to 10-septate, most of them being 6- to 8-septate. When young the conidia are subhyaline, but with age they turn light brown. Mature conidia are obclavate, straight or slightly curved, tapering toward the rounded apex, with conspicuous hilum. Measurements of 200 conidia from field materials reveal that the lengths range from 41.2 to 108.9 μ and the widths, from 11.9 to 22.1 μ. The average size is 74.17 $\pm$ 1.13 $\times$ 16.07 $\pm$ 0.17 μ.

The conidia vary greatly in length but very slightly in width. Most of the conidia fall within the length classes from 61.0 to 86.9 and within the width classes from 13.0 to 18.99 μ (table 4). The majority have a length-to-width ratio ranging from 3.5 to 5.49 (table 5).

Physiology

Growth and conidial production of the fungus on different agar media. The growth and conidial production of the fungus were studied on eight culture media, namely, potato-dextrose agar, kapok decoction agar, onion agar, corn meal agar, nutrient-dextrose agar, nutrient agar, malt agar, and water agar. Triplicate cultures in Petri dishes were made for each medium. The plated media were planted at the center with a bit of potato-dextrose agar containing mycelial fragments of the fungus. The amounts of inoculum transferred to the plates were made as uniform as possible. The planted plates were incubated at room temperature (27° to 28°C.). The diameter of the mycelial growth was measured daily, and the sporulation of the fungus was observed after six days. The fungus produced no spores on all the media used. Changes in color of the colony as well as the media were noted. The colors were named according to Ridgway's [3] color standards. The results are summarized in table 6.

Effects of varying hydrogen-ion concentrations on growth and conidial production of the fungus. To determine the effects of varying hydrogen-ion concentrations on growth and conidial production, the fungus was grown on potato-dextrose agar with pH ranging from 1.4 to 10.4. The agar medium was adjusted to the desired pH by the addition of either N/20 HCl or N/20 NaOH. The pH readings were determined with the aid of a LaMotte colorimeter. Triplicate cultures were made for each pH. All cultures were kept at ordinary room temperature (27° to 28°C.). The diameter of the mycelial growth was taken daily for six days and the production of conidia was observed. The results are presented in table 7.

The fungus grew best on the medium with pH 7.4. The gross differences in mycelial growth at pH 6.4, 7.4, and 8.4 were very slight. At pH 9.4 and 10.4, growth was fairly abundant. A very slow growth was produced at pH 3.4. No growth was observed at pH 1.4 and 2.4. The experiment was repeated and practically the same results were obtained.

Germination of conidia. Conidia taken from diseased specimens were mounted on hanging drops of tap and sterile water in van Tieghem cells and on thin layers of potato-dextrose agar on glass slides. The slide mounts were incubated in a moist chamber. These preparations were observed every hour for the germination of spores. The conidia germinated within 30 minutes to 24 hours. Those mounted in sterile and tap water did not differ markedly in the length of time required for germination. The greatest number of conidia germinated on potato-dextrose agar. The conidia usually germinate by the production of hyaline germ tubes from the apical cells and sometimes from the basal cells.

[3] R. Ridgway, "Color Standards and Color Nomenclature," Robert Ridgway, Washington, D.C., 1912, 43 pp.

Viability of spores. At the start of the work, diseased kapok leaves which had abundant spores were placed in dry receptacles and in pots of sterilized soil kept in the shade and protected from rain. After one month, spores were scraped off carefully from the diseased specimens and tested for their viability in sterile water in van Tieghem cells and on potato-dextrose agar on glass slides. Spores from the specimens stored in potted sterilized soil lost their viability after one month. Those from the specimens stored in dry receptacles lost their viability within the second month.

Taxonomy

The cause of the leaf spot of kapok is *Helminthosporium ceibae* Orillo. This fungus was first observed in January, 1952, and was described as new by the senior author [4] in 1955.

Pathogenicity

To test the pathogenicity of the fungus, kapok seedlings at different ages were inoculated by four methods. The seedlings were grown from seeds obtained from the Department of Agronomy.

Inoculation with mycelial smears. On August 4, 1953, mycelium with bits of medium from a 15-day-old potato-dextrose agar culture was smeared on the surface of the leaves and shoots of kapok seedlings. Fifteen 35-day-old seedlings were used. Five of the seedlings were pricked slightly with sterilized pins before the inoculum was smeared on. The other seedlings were not injured. The control seedlings were smeared with sterile potato-dextrose agar. The inoculated and the control plants were placed side by side inside the damp chamber. The plants were sprayed occasionally with sterile water so as to keep the inoculum moist. After 48 hours inside the damp chamber, the inoculated and control plants were taken outside the laboratory and placed under the shade for observation on the appearance of the disease. The earliest symptoms of the disease appeared on the inoculated plants in 7 to 15 days, infection being more pronounced on the injured leaves. The control plants remained healthy throughout the period of observation.

Inoculation with mycelial suspension. On September 15, 1953, the foliage of fifteen 50-day-old kapok plants was sprayed with mycelial suspension prepared with the aid of a Waring blendor. Five plants were used as control. All other treatments given to the plants were the same as those in the preceding experiment, except that sterile water was sprayed on the control plants.

Characteristic symptoms were noted on the leaves of the inoculated plants in practically the same number of days after inoculation as in the previous experiment. A greater number of spots, however, was observed on the inoculated plants in this experiment than in the previous one. This is perhaps due to the fact that the

[4] Orillo, *op. cit.*

inoculum was sprayed more uniformly on the leaves of the plants. The check plants kept under similar conditions remained healthy throughout the experiment.

Inoculation with conidial suspension. On October 1, 1953, heavily infected leaves bearing abundant spores were carefully scraped off with a sterile razor blade, and the conidia were suspended in sterile water in a DeVilbiss atomizer. Ten 60-day-old kapok plants growing in pots of sterilized soil were thoroughly sprayed with the spore suspension. Three plants of the same variety and age were sprayed with sterile water alone. The inoculated and control plants were placed inside the damp chamber for 48 hours. Then they were transferred outside the laboratory and observed for the appearance of the disease. The earliest symptom of the disease appeared on the inoculated plants 7 to 15 days after inoculation. The control plants remained healthy throughout the period of observation.

Planting in infested soil. On June 8, 1954, kapok seeds which had been disinfected with mercuric bichloride solution (1:1000) were planted in pots containing a mixture of sterilized soil and infected leaves. The pots were watered regularly and the plants that grew from the seeds were observed daily for the appearance of the disease. The earliest visible symptom of the disease appeared 30 days after planting. The spots appeared mostly on the first two oldest leaves of the infected plants. All of the 35 plants grown in infested soil showed the disease. No infection was observed on the 15 plants grown in sterilized soil alone.

Reisolation of the fungus. In every inoculation experiment the causal fungus was reisolated. In all cases the morphological and cultural characteristics of the reisolated fungus were identical with those of *Helminthosporium ceibae,* the fungus originally used.

Host range

Cross inoculation experiments were conducted to determine whether or not *Helminthosporium ceibae* would infect plants other than kapok. The following plants belonging to two families were tested: Family Bombacaceae—malabulak (*Gassampinus reptaphylia* [Hautt] Bakh.), balsa (*Ochroma lagopus* Sw.), and durian (*Dario zebethinus* Merr.) ; Family Euphorbiaceae—lumbang-bato (*Aleurites moluccana* [L.] Willd.), baguilumbang (*Aleurites trisperma* Blanco), and cassava (*Manihot utilissima* Pohl.).[5] The plants were grown in pots and inoculated with mycelial suspension of the fungus. The treatments given the plants were exactly the same as those employed in the inoculation experiments with kapok plants. Control plants were provided for each species. In spite of repeated inoculations, not one of the six species of plants became infected.

[5] Identified by Mr. J. V. Pancho of the Department of Agricultural Botany.

LIFE HISTORY OF THE CAUSAL FUNGUS IN RELATION TO PATHOGENESIS

Seasonal occurrence of the disease. Field observations have shown that the disease is hardly noticeable during the dry season in the propagating plots of the Department of Agronomy. It is practically absent from the later part of April up to the early part of June, possibly because of low atmospheric humidity. At the start of the rainy season new infection on the lower leaves appears. As the rainy season advances the disease becomes more severe. The writers observed that in August, when rains were frequent, almost all the plants in the field were infected in varying degrees of severity. This seems to indicate that moisture greatly influences the development of the disease.

Methods of infection. Inoculation experiments have shown that *Helminthosporium ceibae* is capable of infecting uninjured and injured leaves. It is also probable that infection in the field takes place through injuries caused by insects.

Method of dissemination. On August 12, 1953, six Petri dishes containing sterile potato-dextrose agar were exposed in the field. All of the plates were exposed to the wind for 30 minutes, two plates each being placed at distances of 2, 4, and 6 meters from the leeward edge of a plot of infected kapok plants. After exposure, the plates were incubated in the laboratory at ordinary room temperature (27° to 28°C.). After three days, typical growth of *Helminthosporium ceibae* was observed on all the exposed Petri dishes. The dishes that were exposed 2 meters away from the infected plants had the most growth. The results indicate that the fungus can be disseminated by wind.

Method of tiding over from season to season. Infected leaves that fall off are usually left under the kapok seedlings. These leaves contain mycelium and conidia of the fungus and serve as source of inoculum for newly formed leaves.

CONTROL MEASURES

Sources of inoculum should be eliminated by gathering and burning all infected plants and plant remains.

Seeds for planting purposes should come from healthy pods. Seeds from unknown sources should be disinfected with mercuric bichloride (1:1000) for at least five minutes and washed in two or more changes of water. Kapok seeds for planting should be cleaned and kept in a dry container.

TABLE 1.—*Distribution of lengths and widths of 100 hyphal cells of Helminthosporium ceibae*

LENGTH CLASS IN MICRONS	NUMBER OF HYPHAL CELLS	WIDTH CLASS IN MICRONS	NUMBER OF HYPHAL CELLS
13.0–14.99	2	3.0–3.99	87
15.0–16.99	0	4.0–4.99	0
17.0–18.99	5	5.0–5.99	13
19.0–20.99	7	—	—
21.0–22.99	3	—	—
23.0–24.99	5	—	—
25.0–26.99	2	—	—
27.0–28.99	12	—	—
29.0–30.99	0	—	—
31.0–32.99	6	—	—
33.0–34.99	8	—	—
35.0–36.99	7	—	—
37.0–38.99	13	—	—
39.0–40.99	8	—	—
41.0–42.99	2	—	—
43.0–44.99	2	—	—
45.0–46.99	2	—	—
47.0–48.99	3	—	—
49.0–50.99	0	—	—
51.0–52.99	4	—	—
53.0–54.99	2	—	—
55.0–56.99	3	—	—
57.0–58.99	4	—	—

Average size of hyphal cells = $34.66 \pm 1.14 \times 3.55 \pm 0.09\mu$

TABLE 2.—*Distribution of lengths and widths of 200 conidiophores of Helminthosporium ceibae*

LENGTH CLASS IN MICRONS	NUMBER OF CONIDIOPHORES	WIDTH CLASS IN MICRONS	NUMBER OF CONIDIOPHORES
197.0–198.9	10	3.0–4.9	8
199.0–200.9	9	5.0–6.9	132
201.0–202.9	44	7.0–8.9	60
203.0–204.9	30	—	—
205.0–206.9	45	—	—
207.0–208.9	8	—	—
209.0–210.9	8	—	—
211.0–212.9	22	—	—
213.0–214.9	9	—	—
215.0–216.9	4	—	—
217.0–218.9	5	—	—
219.0–220.9	3	—	—
221.0–222.9	3	—	—

Average size of conidiophores = $205.15 \pm 0.93 \times 6.94 \pm 0.08\mu$

TABLE 3.—*Ratio of length to width of 200 conidiophores of Helminthosporium ceibae distributed in classes made by a difference of 0.5*

RATIO CLASS	NUMBER OF CONIDIOPHORES
1:	
23.0–23.49	2
23.5–23.99	7
24.0–24.49	32
24.5–24.99	3
25.0–25.49	5
25.6–25.99	8
26.0–26.49	0
26.5–26.99	0
27.0–27.49	0
27.5–27.99	0
28.0–28.49	0
28.5–28.99	0
29.0–29.49	6
29.5–29.99	19
30.0–30.49	20
30.5–30.99	6
31.0–31.49	13
31.5–31.99	21
32.0–32.49	5
32.5–32.99	10
33.0–33.49	1
33.5–33.99	0
34.0–34.49	0
34.5–34.99	0
35.0–35.49	4
35.5–35.99	1
36.0–36.49	1
36.5–36.99	0
37.0–37.49	2
37.5–37.99	0
38.0–38.49	0
38.5–38.99	4
39.0–39.49	8
39.5–39.99	9
40.0–40.49	6
40.5–40.99	2
41.0–41.49	1
41.5–41.99	0
42.0–42.99	2
42.5–42.99	2
Average ratio = 29.20	

TABLE 4.—*Distribution of lengths and widths of 200 conidia of Helminthosporium ceibae*

LENGTH CLASS IN MICRONS	NUMBER OF CONIDIA	WIDTH CLASS IN MICRONS	NUMBER OF CONIDIA
41.0– 42.99	1	11.0–12.99	8
43.0– 44.99	1	13.0–14.99	46
45.0– 46.99	1	15.0–16.99	33
47.0– 48.99	1	17.0–18.99	99
49.0– 50.99	0	19.0–20.99	11
51.0– 52.99	2	21.0–22.99	3
53.0– 54.99	10	—	—
55.0– 56.99	2	—	—
57.0– 58.99	7	—	—
59.0– 60.99	9	—	—
61.0– 62.99	11	—	—
63.0– 64.99	8	—	—
65.0– 66.99	9	—	—
67.0– 68.99	14	—	—
69.0– 70.99	8	—	—
71.0– 72.99	9	—	—
73.0– 74.99	23	—	—
75.0– 76.99	0	—	—
77.0– 78.99	15	—	—
79.0– 80.99	7	—	—
81.0– 82.99	6	—	—
83.0– 84.99	12	—	—
85.0– 86.99	14	—	—
87.0– 88.99	6	—	—
89.0– 90.99	1	—	—
91.0– 92.99	3	—	—
93.0– 94.99	0	—	—
95.0– 96.99	4	—	—
97.0– 98.99	3	—	—
99.0–100.99	2	—	—
101.0–102.99	5	—	—
103.0–104.99	2	—	—
105.0–106.99	2	—	—
107.0–108.99	2	—	—

Average size of conidia = $74.17 \pm 1.13 \times 16.07 \pm 0.17\mu$

TABLE 5.—*Ratio of length to width of 200 conidia of Helminthosporium ceibae distributed in classes made by a difference of 0.5*

RATIO CLASS	NUMBER OF CONIDIA
1:	
2.0–2.49	2
2.5–2.99	3
3.0–3.49	11
3.5–3.99	22
4.0–4.49	64
4.5–4.99	49
5.0–5.49	32
5.5–5.99	9
6.0–6.49	4
6.5–6.99	1
7.0–7.49	2
7.5–7.99	1
Average ratio = 4.52	

TABLE 6.—*Growth characteristics and mycelial production of Helminthosporium ceibae*

MEDIUM	GROWTH CHARACTERISTICS	DIAMETER OF COLONY AFTER 6 DAYS [a]	AVERAGE DAILY GROWTH
		mm.	*mm.*
Potato-dextrose agar	Within 24-48 hours very abundant mycelium produced varying from white to dull white. Culture medium changed from pale pinkish buff to pinkish buff.	38.33	6.39
Kapok decoction agar	Fairly abundant, white to dull white mycelium produced within 24–48 hours. Culture medium changed from cartridge buff to pale pinkish buff.	37.33	6.22
Onion agar	Fairly abundant, compact mycelium, white to dull white when old; growth produced after 24–48 hours. Culture medium changed from pale olive buff to tilleul buff.	29.66	4.94
Corn meal agar	Thin, dull to dull white mycelium produced within 24–48 hours. Culture medium changed from pale brownish vinaceous to vinaceous buff.	19.66	3.28
Nutrient dextrose agar	Thin, dull white mycelial growth produced within 2–3 days. Culture medium changed from light vinaceous fawn to vinaceous buff.	30.66	5.11
Nutrient agar	Mycelium very abundant; white to dull white growth produced within 24-48 hours. Culture medium changed from pale brownish drab to light cinnamon drab.	23.00	3.83
Malt agar	Very thin, white to dull white mycelial growth within 3–4 days. Culture medium changed from light cinnamon-drab to cinnamon-drab.	24.00	4.00
Water agar	No growth produced.	—	—

[a] Average of three cultures.

TABLE 7.—*Growth and conidial production of Helminthosporium ceibae on potato-dextrose agar of different hydrogen-ion concentrations*

pH OF MEDIUM	COMPARATIVE ABUNDANCE OF MYCELIUM	COMPARATIVE ABUNDANCE OF CONIDIA	DIAMETER OF COLONY AFTER 6 DAYS [a]	AVERAGE DAILY GROWTH
			mm.	*mm.*
1.4	None	None	—	—
2.4	None	—	—	—
3.4	Very scarce	—	3.33	0.56
4.4	Scarce	—	27.00	4.50
5.4	Abundant	—	36.33	6.06
6.4	Fairly abundant	—	42.66	7.11
7.4	Very abundant	—	47.00	7.83
8.4	Very abundant	—	45.66	7.61
9.4	Fairly abundant	—	40.33	6.72
10.4	Abundant	—	39.33	6.56

[a] Average of three cultures.

GERMINATED MUNGO MEAL AS A PROTEIN SUPPLEMENT IN A GROWING RATION FOR CHICKS [1]

ROMANA R. PADLAN

WITH FOUR TEXT FIGURES

The heaviest chicks with the least mortality were those in the lot fed 20 per cent fish meal and no germinated mungo meal (lot I); the second best chicks were those in the lot given 15 per cent fish meal and 5 per cent germinated mungo meal (lot II); and the poorest were those in the lot given equal parts of fish meal and germinated mungo meal (lot III). In economy of feeding, lot I ranked first, followed by lots II and III.

The results of the study prove that germinated mungo meal cannot replace even 5 parts of the fish meal constituent of the College chick ration. However, when the supply of fish meal is low or when its price is too high or when mungo is plentiful and cheap, germinated mungo meal may economically replace 5 parts of fish meal.

Vegetable proteins have been shown to be inadequate for inducing a normal rate of growth in chicks [2] so that mungo (*Phaseolus aureus* Linn.) has not been used much in poultry feeding. Adan showed that mungo meal as the sole protein constituent in growing rations led to abnormal sexual development of chicks, high mortality, and poor feather development.[3] Rodriguez reported, however, that fair results may be obtained by replacing 20 to 40 per cent of shrimp meal in the rations for growing chicks with an equal amount of mungo meal.[4] Santos observed that the substitution of a greater amount of fish meal with mungo meal, even with the addition of APF, yielded poor results.[5] Similarly, Lagman proved that although APF markedly improved an all-vegetable ration containing roasted mungo meal as the major protein ingredient, the improvement was not enough to justify the elimination of animal protein ingredients from growing rations.[6]

Although vegetable proteins are inferior to animal proteins in biological value, dried germinated mungo meal might still replace a part of fish meal in chick rations. To find out if this is possible, an experiment was conducted in the Department of Animal Husbandry from December, 1952, to March, 1954.

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[1] Central Experiment Station Contribution No. 1815. Thesis presented for graduation with the degree of Bachelor of Science in Agriculture from the College of Agriculture, June, 1954. Prepared in the Department of Animal Husbandry under the direction of Professor F. M. Fronda and Instructor A. C. Campos.

[2] R. Emerson *et al.*, *Poultry Sci.*, 28, 431 (1939).

[3] Claudio N. Adan, *Philippine Agriculturist*, 24, 562 (1935).

[4] Felino L. Rodriguez, *Philippine Agriculturist*, 25, 541 (1936).

[5] Severino R. Santos, Jr., *Philippine Agriculturist*, 36, 83 (1952).

[6] Alfonso M. Lagman, *Philippine Agriculturist*, 36, 210 (1952).

MATERIALS AND METHODS

Three trials, each covering 12 weeks, were conducted on 450 day-old wingbanded New Hampshire chicks. Each trial consisted of three lots with 50 chicks to a lot. The first trial was from February 26 to May 21, 1953; the second, from March 25 to June 27, 1953; and the third, from December 9, 1953, to March 3, 1954.

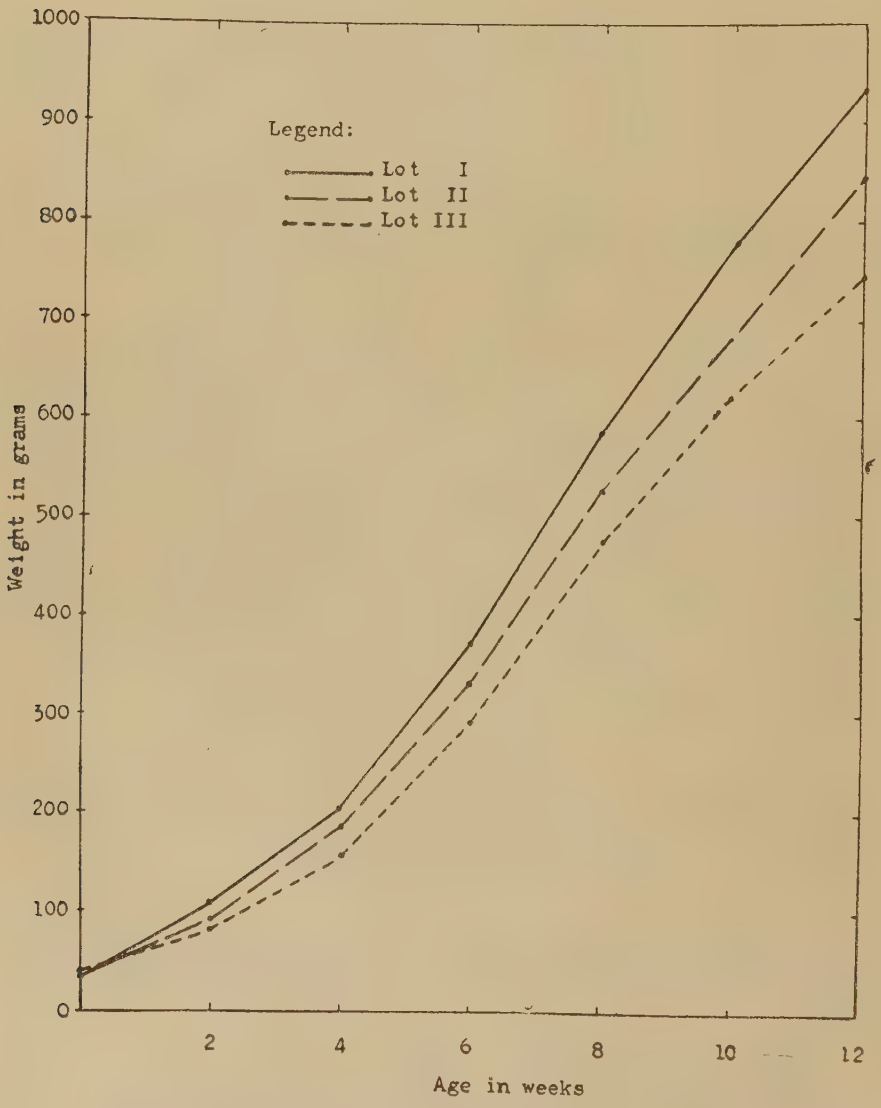

Fig. 1.—Average weights of New Hampshire chicks at different ages in the three lots.

The rations given to the chicks consisted of the following ingredients, all parts by weight:

	LOT I	LOT II	LOT III
Fine rice bran	55	55	55
Corn meal	20	20	20
Fish meal	20	15	10
Copra meal	5	5	5
Germinated mungo meal	0	5	10
Common table salt	1	1	1

From the fourth week until the end of the experiment, the chicks were supplied with finely chopped green ipil-ipil (*Leucaena glauca* Linn.) leaves four times a week. They were allowed free access to water, ground grit, and shells.

Fig. 2.—A typical 12-week-old New Hampshire weanling from lot I. (*Photographed by the Photographic Division*).

The germinated mungo meal was prepared by germinating mungo seeds till the sprouts were about three centimeters long and then drying and grinding the sprouts. The proximate chemical analysis of the germinated mungo meal, as determined by the Department of Agricultural Chemistry, was as follows:

	AVERAGE
Moisture	14.90
Crude protein (N × 6.25)	24.84
Crude fats (ether extracts)	1.54
Carbohydrates (N.F.E.)	48.56
Calorific value per 100 grams	3152.62
Crude fibers	5.93
Ash	4.23

RESULTS AND DISCUSSION

Rate of growth. The influence of the varying amounts of fish and germinated mungo meal on the rate of growth of the chicks is shown in table 1 and figure 1. On the twelfth week of the combined trials, the average weight of lot I (fig. 2) was higher than that of lot II (fig. 3) and much higher than that of lot III (fig. 4). The su-

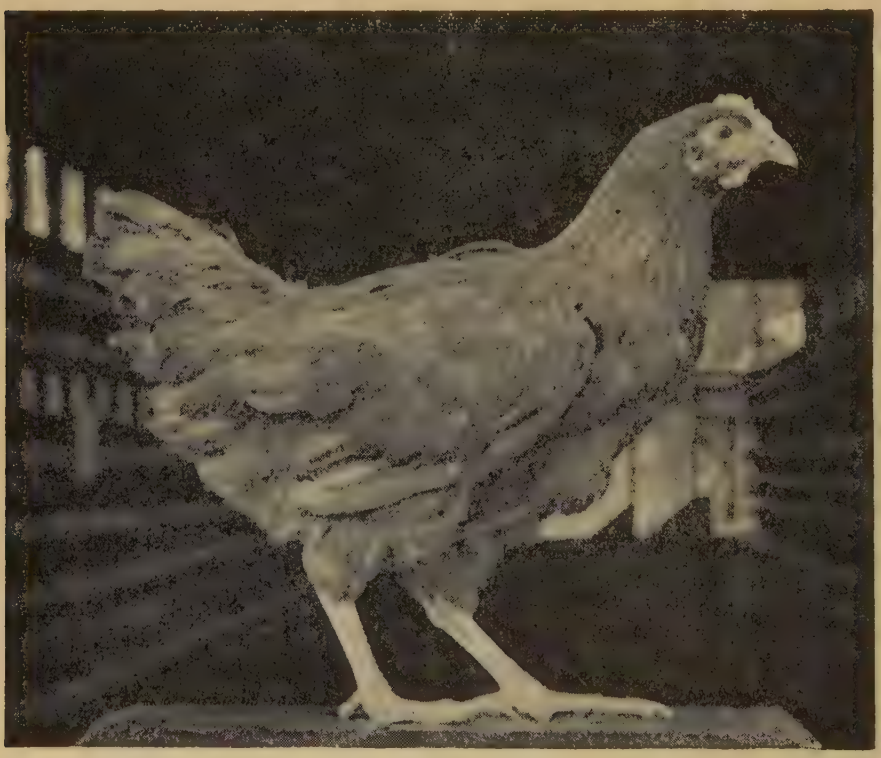

Fig. 3.—A typical 12-week-old New Hampshire weanling from lot II. (*Photographed by the Photographic Division*).

periority of lot I over the other lots may be explained by the high fish meal content of its ration; the same explanation is true for the superiority of lot II over lot III. It appears that for inducing superior growth in young chicks, germinated mungo meal cannot very satisfactorily replace fish meal.

Feed consumption and cost. Lot I had the highest average feed consumption, followed by lot II and lot III (table 2). The same trend was observed by Badua.[7] The low consumption of feed by the lots fed germinated mungo meal may be attributed to the lighter body weights of the birds in these lots.

With the amount of feed required for every kilogram gain in weight as the measure of efficiency of feed utilization, lots I and II had practically the same rating (table 2). Since chickens are fed for profit, the returns above feed cost may be considered as the final test of the rations. In this regard, lot I had the highest returns and lot III had the lowest.

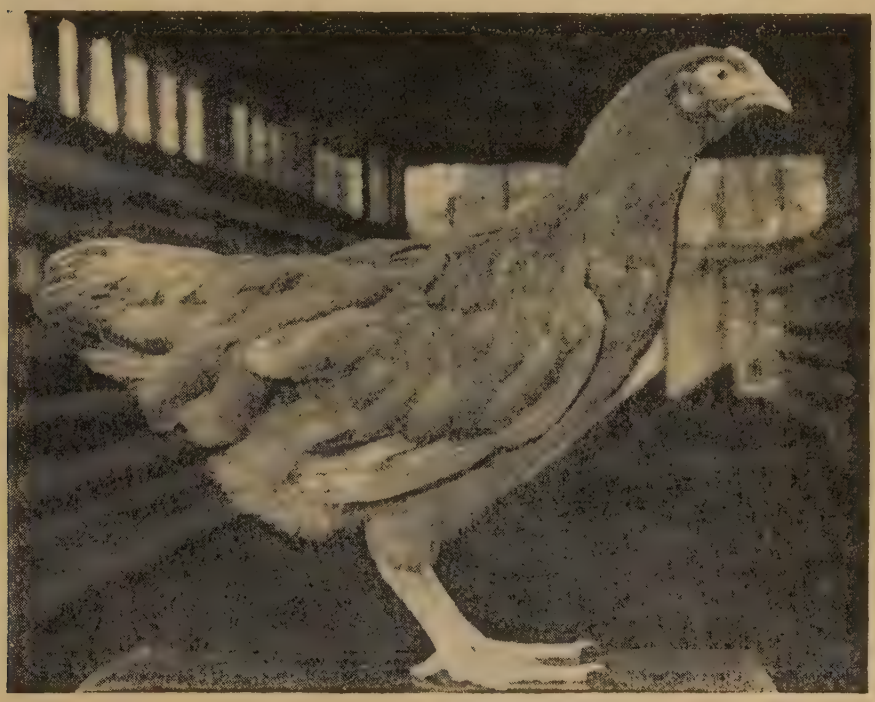

Fig. 4.—A typical 12-week-old New Hampshire weanling from lot III. (*Photographed by the Photographic Division*).

On the basis of feed consumption and cost, germinated mungo meal may partly replace the fish meal in the College chick ration if the price of germinated mungo meal can be brought down to a level much lower than that of fish meal; otherwise, incorporating germinated mungo meal in the chick ration would be impractical.

[7] Felipe C. Badua, "The Influence of Rations with Varying Amounts of Fish and Mungo (*Phaseolus aureus* Linn.) Meals Supplemented with Cow Manure on the Growth of Chicks." (Thesis presented for graduation with the degree of Bachelor of Science in Agriculture from the College of Agriculture, 1950. Unpublished.)

Mortality. The average percentage mortality was highest in lot III and lowest in lot I (table 3). That the protein in mungo is not only lower in percentage but also poorer in quality than the protein in fish meal may be the reason for the high death rates in the lots fed germinated mungo.

The unusually high mortality in all the lots in trial 2 was due to coccidiosis and roup which broke out during the experiment. The administration of sulfamethazine failed to check the severity of the diseases.

Minor observations. Aside from normal body growth, the control lot showed normally developed feathers, shorter and stockier beaks, fair degree of pigmentation, and pronounced comb and wattle development. On the other hand, the lots fed germinated mungo exhibited rather long, thin, and elongated beaks; less deposition of pigment in the shanks, beaks, and skin; and less developed combs and wattles. Feather development appeared to be the same as in the control lot. The feces of the control lot were solid, but those of the experimental lots were watery. This may be attributed to the laxative effect of germinated mungo meal.

TABLE 1.—*Average initial and biweekly weights in grams of New Hampshire chicks*

AGE IN WEEKS	LOT I				LOT II				LOT III			
	Trial			Average	Trial			Average	Trial			Average
	1	2	3		1	2	3		1	2	3	
Initial	37.7	40.9	33.8	37.4	37.6	40.7	34.0	37.4	38.2	41.2	34.6	38.0
2	108.0	101.2	94.4	101.2	102.5	94.4	91.9	96.2	98.2	89.9	90.0	92.7
4	198.2	171.9	229.9	200.0	155.5	169.0	220.6	181.4	134.4	136.2	207.1	159.2
6	358.4	317.4	435.2	370.3	317.8	283.1	414.2	338.4	259.0	249.0	374.6	294.2
8	545.1	512.3	701.2	506.2	478.7	419.4	690.2	529.4	402.1	410.8	620.5	477.8
10	737.3	684.1	903.5	774.9	660.6	567.9	853.6	683.6	580.1	544.7	781.1	625.3
12	984.9	842.6	973.7	933.4	868.5	745.0	915.1	842.9	765.3	660.0	803.3	742.9

TABLE 2.—*Amount and cost of feeds consumed and returns above feed cost*

ITEM	LOT I				LOT II				LOT III			
	Trial			Average	Trial			Average	Trial			Average
	1	2	3		1	2	3		1	2	3	
Total amount of feed consumed, kilograms	128.2	101.95	157.6	129.25	116.3	94.5	142.9	117.9	102.2	87.4	135.6	108.4
Total cost of mash feed, pesos[a]	30.38	24.16	37.35	30.63	28.00	22.02	33.30	27.47	23.30	19.93	30.91	24.72
Average gain in weight of each bird, kilograms	.95	.80	.94	.90	.83	.70	.88	.80	.73	.62	.77	.71
Average feed consumption of each bird, kilograms	3.29	3.64	3.43	3.45	3.52	2.95	3.04	3.17	3.01	2.91	3.08	3.00
Feed required for every kilogram gain in weight, kilograms	3.46	3.82	3.65	3.64	4.24	4.21	3.45	3.97	4.22	4.69	4.00	4.27
Cost of feed to produce a kilogram gain, pesos	.82	.84	.87	.84	.99	.98	.80	.93	.64	1.07	.91	.98
Weight of weanlings produced, kilograms[b]	38.41	23.60	44.79	35.60	28.66	23.84	43.03	31.84	26.02	19.80	35.35	27.06
Returns from sales of weanlings, pesos	76.82	47.20	89.58	71.20	57.32	47.68	86.06	63.68	52.04	39.60	70.70	54.12
Returns above feed cost, pesos	36.44	23.04	52.23	40.57	29.32	25.66	52.76	36.21	28.74	19.67	39.79	29.40

[a] Cost of a kilogram of mash feed: lot 1—₱.237; lot 2—₱.233; lot 3—₱.228.
[b] Weanlings were priced at ₱2.00 live weight.

TABLE 3.—*Percentage of mortality*

ITEM	LOT I				LOT II				LOT III			
	Trial			Total	Trial			Total	Trial			Total
	1	2	3		1	2	3		1	2	3	
Number of chicks at start	50	50	50	150	50	50	50	150	50	50	50	150
Number of chicks after 12 weeks ..	39	28	46	113	33	32	47	112	34	30	44	108
Number of chicks that died	11	22	4	37	17	18	3	38	16	20	6	42
Percentage of mortality	22.0	44.0	8.0	24.6	34.0	36.0	6.0	25.3	32.0	40.0	12.0	28.0

THE OPTIMUM LEVEL OF COMMON TABLE SALT IN THE COLLEGE BROODING RATION[1]

FELICIANO B. AGDIGOS

The addition of 1 per cent common table salt to the College ration for growing chicks markedly improved the feeding value of the ration. The rate of growth was faster and mortality was lower during the second and third months in the lot given 1 per cent salt.

Although common table salt is a common ingredient of College chick rations, its optimum level for chick growth has not been studied. Ewing[2] reported that Ontario workers found 3 per cent salt supplement as the minimum toxic level and 1 per cent as the optimum level for nine-week-old chicks. Growth was superior in the two groups receiving zero to ½ per cent salt. He further stated that Mitchel, Card, and Carman, in 1926, found that an excess of common table salt up to 8 per cent in the ration had no apparent detrimental effect on the chicks.

Since it is important to know the nutritional limits within which salt can vary in chick diets without causing ill effects, this study was conducted in the Poultry Division of the Department of Animal Husbandry from April, 1953, to March, 1954.

MATERIALS AND METHODS

Four hundred fifty day-old New Hampshire chicks hatched from eggs produced by the College stock were raised in three trials lasting 12 weeks each. The first trial was from April 1 to June 24, 1953; the second, from November 29, 1953, to February 20, 1954; the third, from December 30, 1953, to March 24, 1954. Each trial was conducted on three lots of 50 chicks each.

The chicks in all the lots were raised in electrically heated battery brooders during the first four weeks of the experiment. They were then transferred to unheated and more spacious battery cages, where they remained until the end of the 12-week period.

The basal ration was the College all-mash growing ration, which consists of the following ingredients, all parts by weight:

Rice bran	55
Ground corn	20
Fish meal	20
Copra meal	5

[1] Central Experiment Station Contribution No. 1816. Thesis presented for graduation with the degree of Bachelor of Science in Agriculture from the College of Agriculture, April, 1954. Prepared in the Department of Animal Husbandry under the direction of Research Professor F. M. Fronda.

[2] W. R. Ewing, "Poultry Nutrition," W. Ray Ewing, South Pasadena, California, 1951, 1518 pp.

The ration given to lot I did not contain common table salt; that given to lot II consisted of 99 parts of the basal ration and 1 part common table salt; that given to lot III, 98 parts basal ration and 2 parts common table salt.

The feed was given in ample amounts in the morning and in the afternoon. Water, ground shells, and grit were made available to the birds at all times. From the second to the twelfth week, finely chopped green leaves and young shoots of ipil-ipil (*Leucaena glauca* Linn.) were mixed with the basal feed.

The initial and biweekly weights, amount and cost of feed consumed, percentage of mortality, and minor observations were recorded.

RESULTS AND DISCUSSION

Rate of growth. Table 1 shows the average initial and biweekly weights of the chicks in all the trials. Statistical analysis showed consistently significant differences in the weights of male birds in all the trials. The mean weights of the male birds in lot I ranged from 922.60 to 1,129.23 grams; in lot II, 802.80 to 1,093.57 grams; and in lot III, 624.22 to 809.20 grams. The difference was also significant for female birds in trial 3. The mean weight in lot I was 809.20 grams; lot II, 951.35 grams; and in lot III, 694.55 grams. These results corroborate those reported by Barlow *et al.*[3] for male birds and some female birds in certain seasons.

Amount and cost of feed consumed. In all the trials, lot II had the highest average feed consumption; lot I had the next highest; and lot III had the least (table 2). Lot II required the least feed to produce a kilogram gain in weight, and lot I required the most. Also, since salt cost less than any of the feed ingredients in the ration, the salt-supplemented ration was cheaper than the unsupplemented one.

The results show that 1 per cent salt added to the College growing ration greatly improved the feeding value of the ration and 2 per cent inhibited the growth of the young chicks. These findings are similar to those reported by Heuser.[4]

Mortality. In the lots given salt, the death rate was highest during the first month of the experiment; in the control lot, it was highest during the last month. Since the chicks that died in lots II and III showed no symptom of the common poultry diseases, salt must have had a toxic effect on the young chicks. The chicks in lot I were more susceptible to the common chick diseases during the last two months of the experiment. Coccidiosis, roup, and pyemial infections[5] were the main causes of the mortality in all the

[3] J. S. Barlow, S. J. Slinger, and R. F. Zimmer, *Poultry Sci.*, 27, 542 (1948).

[4] G. F. Heuser, *Poultry Sci.*, 31, 85 (1952).

[5] Determined by Dr. G. V. Garcia, the College veterinarian.

lots. These findings clearly indicate that birds over one month old given 1 per cent salt in their ration are in better condition to ward off minor attacks of the common poultry diseases.

Minor observations. The water consumption of the chicks increased progressively with an increase in the amount of salt in the diet. Even in the lot fed 1 per cent salt, the water consumption increased very noticeably. As a result of the high water consumption, the salt-fed chicks voided watery droppings. Barlow *et al.*[6] attributed the increase in water intake of the chicks given a salt-supplemented diet to their attempt to maintain equal osmotic pressure of the body fluids.

[6] Barlow *et al., op. cit.*

TABLE 1.—*Average initial and biweekly weights in grams of the New Hampshire chicks*

AGE IN WEEKS	LOT I				LOT II				LOT III			
	Trial			Average	Trial			Average	Trial			Average
	1	2	3		1	2	3		1	2	3	
Initial	39.1	34.6	36.5	36.7	37.6	34.4	35.1	35.5	37.4	34.4	35.2	36.7
2	91.7	83.6	94.7	90.1	93.7	95.1	102.5	95.6	77.9	78.5	83.3	79.9
4	199.0	243.0	252.0	232.2	199.7	284.9	271.0	249.6	188.7	234.7	238.8	219.9
6	274.8	435.1	432.0	385.9	283.4	497.7	496.3	426.2	236.6	410.0	408.4	361.4
8	380.3	607.5	607.1	537.5	425.9	695.3	690.4	604.9	372.8	577.5	569.0	499.1
10	523.9	785.4	746.4	695.2	579.1	823.3	890.5	768.0	470.6	697.5	676.8	616.4
12	652.2	887.6	843.3	809.6	802.5	981.1	974.3	929.7	611.0	770.0	757.6	725.5

TABLE 2.—*Amount and cost of feed to produce a kilogram gain in weight*

ITEM	LOT I				LOT II				LOT III			
	Trial			Average	Trial			Average	Trial			Average
	1	2	3		1	2	3		1	2	3	
Total amount of feed consumed, kilograms	88.9	178.2	192.2	153.0	95.7	190.2	176.8	154.5	80.2	155.6	148.5	128.1
Total cost of feed consumed, pesos[a]	21.42	42.74	46.27	36.87	22.87	45.45	42.25	36.92	19.00	36.88	35.19	30.36
Gain in weight, kilograms	15.12	30.15	32.76	26.01	22.84	40.29	36.22	33.66	14.95	28.91	26.95	23.60
Feed required for every kilogram gain in weight, kilograms	5.88	5.91	5.86	5.88	4.19	4.72	4.88	4.59	5.36	5.36	5.51	5.41
Cost of feed to produce a kilogram gain, pesos	1.41	1.42	1.41	1.41	1.00	1.28	1.17	1.09	1.27	1.27	1.30	1.28

[a] Cost of a kilogram mash mixture: Lot I, ₱0.241; lot II, ₱0.239; lot III, ₱0.237.

TABLE 3.—*Mortality of the New Hampshire chicks as influenced by the varying amounts of salt in the ration*

ITEM	LOT I				LOT II				LOT III			
	Trial			Total	Trial			Total	Trial			Total
	1	2	3		1	2	3		1	2	3	
Number of chicks at start	50	50	50	150	50	50	50	150	50	50	50	150
Number of chicks in 1st month	4	0	0	4	7	7	11	25	11	10	13	34
Number of chicks in 2nd month	4	4	0	8	5	0	0	5	2	0	0	2
Number of chicks in 3rd month	17	10	8	35	7	6	0	7	12	0	0	12
Number of chicks that died	25	14	8	47	19	7	11	37	25	10	13	48
Percentage mortality	50.00	28.00	16.00	31.33	38.00	14.00	22.00	24.66	50.00	20.00	26.00	32.00

A PLOT TEST OF TWO STRAINS OF WAGWAG RICE UNDER LOWLAND CONDITIONS [1]

MELANIO STA. ANA

Strain No. 471 had the highest percentage of germination, and the control had the lowest. All the seedlings were uniform in stand, vigor, color, and height. Strains No. 471 and 147 and the control flowered and matured practically at the same time, had the same number of bearing culms to a plant, and had the same yield of grain. None of the plants lodged. The two strains gave higher percentages of milling than the control.

Among four varieties of rice, Abella [2] found that Wagwag was the highest yielder and had a good eating quality. In another study, Callejo [3] selected 164 strains out of 500 and reported these strains to be promising. A further test of the 164 strains conducted by Goseco [4] proved that strains No. 23, 147, 427, and 471 were high yielders. Of these strains Mendoza [5] found No. 471 and No. 147 to be the best yielders.

The present study was a further observation of the different agronomic characteristics and comparative yields of the two strains recommended by Mendoza. The work was conducted from July, 1952, to February, 1953, in the Department of Agronomy, College of Agriculture and Central Experiment Station, Los Baños, Laguna.

MATERIALS AND METHODS

A 4500-square-meter lowland rice field of clay loam was prepared in the ordinary wet-bed method. The seeds of strains No. 471 and 147 and the control were prepared for sowing on August 2 and broadcast on August 5, 1952. The field was prepared for transplanting and was divided into 27 plots of 160 square meters each. On September 20, 1952, the seedlings were transplanted to the field 20 to 25 centimeters apart. The seedlings were 44 days old at the time of transplanting. Two weeks after, the missing hills were re-

[1] Central Experiment Station Contribution No. 1817. Thesis presented for graduation with the degree of Bachelor of Science in Agriculture from the College of Agriculture, March, 1954. Prepared in the Department of Agronomy under the direction of Dr. Valeriano C. Calma.

[2] D. M. Abella, "A Study of the Performance of Four Varieties of Rice." (Thesis presented for graduation with the degree of Bachelor of Science in Agriculture from the College of Agriculture, 1949. Unpublished.)

[3] I. G. Callejo, "Variation and Selection of Wagwag Rice." (Thesis presented for graduation with the degree of Bachelor of Science in Agriculture from the College of Agriculture, 1950. Unpublished.)

[4] A. D. Goseco, "Plant-to-the-Row Test of 164 Strains of Wagwag Variety of Rice." (Thesis presented for graduation with the degree of Bachelor of Science in Agriculture from the College of Agriculture, 1951. Unpublished.)

[5] J. S. Mendoza, "A Plot Test of Four Strains of Wagwag Variety of Rice." (Thesis presented for graduation with the degree of Bachelor of Science in Agriculture from the College of Agriculture, 1952. Unpublished.)

planted and weeding was started. The pests attacking the plants were noted and controlled.

The rice was harvested from February 12 to 19, 1953, when the majority of the plants in each plot had matured. The harvest from each plot was threshed separately with a bamboo thresher, known locally as *hampasan,* and then thoroughly dried in the sun. The grains from each plot were weighed. The weight of the filled grains from each plot was determined separately. Five gantas each of well-dried clean palay of the two strains and the control were weighed and milled separately in an Engelberg huller or *kiskisan.* The weight of cleaned rice of each strain and the control was noted.

RESULTS AND DISCUSSION

Strain No. 471 had the highest percentage of germination, and the control had the lowest (table 1). The growth of the seedlings was uneven. There was no marked difference in vigor and height among the two strains and the control. At transplanting the height of strain No. 471 was 34 centimeters; strain No. 147, 32.5 centimeters; and the control, 29.8 centimeters. The seedlings of the two strains and the control were pale in color. A week after transplanting, the seedlings became greener.

Both the strains and the control were attacked slightly by the larvae of a pyralidid moth at the seedling stage; by the rice stem borer, *Schoenobius incertellus* Walker,[6] at the tillering stage; and by the rice bug, *Leptocorisa acuta* Thunberg, at the milk stage.

Strain No. 147 flowered and matured the earliest; strain No. 471 and the control had practically the same length of flowering and maturity periods (table 1).

The two strains and the control did not show any tendency to lodge despite rain, strong winds, and the increased weight of the panicles when they reached the advanced dough stage.

Statistical analysis showed that there was no difference in number of bearing culms among the two strains and the control (table 2). Neither was there any significant difference in their yields (table 3). Based on 44 kilograms of cleaned palay to a cavan, the computed yield to a hectare was 65.07 cavans for the control, 59.83 cavans for strain No. 471, and 58.08 cavans for strain No. 147.

The milling percentage based on the weight of the two strains and the control ranged from 54.4 to 61.8 per cent (table 4). Strain No. 471 gave the highest percentage of cleaned rice, and the control gave the lowest. The differences may be attributed to the difference in thickness of their hulls.

[6] Identified by Dr. Silverio M. Cendaña of the Department of Entomology.

TABLE 1.—*Germination and blooming and maturity periods of the two Wagwag strains and the control*

MATERIAL	GERMINATION [a]	DAYS FROM SOWING TO FLOWERING	DAYS FROM SOWING TO MATURITY
	per cent		
Strain No. 147	95	154	185
Strain No. 471	97	157	187
Control	94	157	187

[a] Based on 100 palay seeds.

TABLE 2.—*Number of bearing culms to a hill based on 10 plants to a replication*

MATERIAL	REPLICATION									TOTAL	MEAN
	I	II	III	IV	V	VI	VII	VIII	IX		
Strain No. 147	12.7	12.5	11.9	12.0	9.9	8.8	13.8	9.1	13.5	104.2	11.58
Strain No. 471	10.7	13.8	11.0	11.9	11.6	10.9	12.2	12.0	13.4	107.5	11.94
Control	14.9	14.5	12.9	13.1	13.1	12.1	10.6	13.1	10.0	114.3	12.70
Total	38 3	40.8	35.8	37 0	34.6	31.8	36.6	34.2	36.9	326.0	

Analysis of variance

SOURCE OF VARIATION	DF	SUM OF SQUARES	MEAN SQUARE	COMPUTED F-VALUE	TABULAR F-VALUE	
					5%	1%
Blocks	8	17.64	2.21			
Strains	2	5.89	2.95	1.18	3.63	6.23
Blocks × strain	16	40.00	2.50			
Total	26	63.53				

TABLE 3.—*Yield of clean palay to a plot in kilograms*

MATERIAL	REPLICATION									TOTAL	MEAN
	I	II	III	IV	V	VI	VII	VIII	IX		
Strain No. 147	51.4	44.6	44.7	43.6	30.8	34.2	36.3	38.1	45.8	369.5	41.05
Strain No. 471	40.0	37.5	48.2	35.8	46.9	51.3	47.2	36.6	35.6	379.1	42.12
Control	45.8	52.5	55.6	46.7	42.2	40.5	40.8	45.1	43.1	412.3	45.81
Total	137.2	134.6	148.5	126.1	119.9	126.0	124.3	119.8	124.5	1160.9	

Analysis of variance

SOURCE OF VARIATION	DF	SUM OF SQUARES	MEAN SQUARE	COMPUTED F-VALUE	TABULAR F-VALUE 5%	TABULAR F-VALUE 1%
Blocks	8	235.35	29.42			
Strains	2	112.08	56.04	1.41	3.63	6.23
Blocks × strain ...	16	634.24	39.64			
Total	26	981.67				

TABLE 4.—*Milling percentage based on five gantas of clean palay of each strain and the control*

MATERIAL	WEIGHT			PERCENTAGE OF	
	Palay	Cleaned rice	Rice hull	Cleaned rice	Rice hull
	kg.	*kg.*	*kg.*		
Strain No. 147	8.9	5.2	3.7	58.4	41.6
Strain No. 471	8.9	5.5	3.4	61.8	38.2
Control	9.0	4.9	4.1	54.4	45.6

THE FEEDING VALUE OF "CONO" AND OF "KISKIS" RICE BRAN IN RATIONS FOR GROWING CHICKS [1]

DANILO D. GORREZ

At 12 weeks of age, the birds fed "Cono" rice bran weighed an average of 744.3 grams, and those fed "kiskis" rice bran, an average of 551.5 grams. The "Cono" lot required 4.91 kilograms of feed, costing ₱1.47, to put on a kilogram weanling weight, whereas the "kiskis" lot required 6.62 kilograms, costing ₱1.59. The average percentage of mortality was 24.1 for lot I and 29.3 for lot II. These results show that the feeding value of "kiskis" rice bran is very much inferior to that of "Cono" rice bran.

Rice bran is widely used in the Philippines to form the bulk of poultry rations, especially those for growing chicks. It is classified into two kinds: the standard rice bran, a by-product of large rice mills called "Cono" mills, and the coarse rice bran, which contains a large amount of ground rice hull and which is a by-product of small rice mills called "kiskisan" mills. Since most barrios and small towns have "kiskisan" mills, the poultrymen in these places use "kiskis" rice bran more than "Cono" bran. Besides, "kiskis" rice bran is cheaper than "Cono" rice bran.

According to Villanoy,[2] sieved "kiskis" rice bran can substitute satisfactorily for "Cono" rice bran in rations for growing chicks. The preparation of sieved "kiskis" rice bran, however, entails much time and labor for the farmers. In fact, farmers use unsieved "kiskis" rice bran as hog feed. To determine how the feeding value of unsieved "kiskis" rice bran compares with that of "Cono" rice bran when given to growing chicks, this study was conducted in the Department of Animal Husbandry from February, 1953, to June, 1954.

MATERIALS AND METHODS

A total of 300 day-old New Hampshire chicks was used in three trials. Each trial consisted of two lots with 50 chicks to a lot. The first trial was conducted from February 17 to May 12, 1953; the second trial, from March 31 to June 23, 1953; and the third trial, from March 24 to June 16, 1954. Soon after hatch, the chicks were wing-banded, individually weighed, and then placed in electrically heated indoor battery brooders. After the fourth week, they were transferred to indoor pens, except in the third trial when the chicks were placed in outdoor rearing cages. They were weighed weekly until they were 12 weeks old.

Except for the kind of rice bran used, both lots were given rations consisting of the same ingredients, all parts by weight:

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[1] Central Experiment Station Contribution No. 1818. Thesis presented for graduation with the degree of Bachelor of Science in Agriculture from the College of Agriculture, October, 1954. Prepared in the Department of Animal Husbandry under the direction of Professor F. M. Fronda.

[2] R. A. Villanoy, *Philippine Agriculturist*, 27, 64 (1953).

Rice bran	55
Ground corn	20
Copra meal	5
Fish meal	20

Lot I received the ration containing "Cono" rice bran; lot II, that with "kiskis" rice bran. The chicks were given finely cut green feed once a week. Water and feed were made available to them at all times.

A physical analysis of the two kinds of rice bran gave the following results:

DEGREE OF COARSENESS IN MILLIMETERS	PERCENTAGE OF PARTICLES "Cono"	"Kiskis"
3.0 and over	0	3.0
2.0—3.0	1.4	26.4
1.0—2.0	7.0	43.2
0.5—1.0	91.0	27.4
Less than 0.5	0.6	0.0

The chemical analyses of the "Cono" and the "kiskis" rice bran as determined in the Department of Agricultural Chemistry are as follows:

CONSTITUENT	"CONO"	"KISKIS"
Moisture	11.61	10.55
Crude protein	21.24	5.15
Crude fats (ether extract)	9.57	5.48
Carbohydrates (N.F.E.)	36.70	60.58
Calorific value per 100 grams	362.55	320.46
Crude fibers	11.87	31.01
Ash	9.01	8.29

RESULTS AND DISCUSSION

Rate of growth. The weekly weights of the birds determined the feeding efficiency of the rations (table 1 and fig. 1). As the chicks grew older, the lot fed with "kiskis" rice bran (lot II) took a longer period to equal a weight attained by the lot given "Cono" rice bran (lot I). In all the trials the chicks in both lots registered a steady gradual increase in weight from the first week to the twelfth week. The growth pattern for both lots was consistent, with lot I remaining heavier than lot II in all instances. At 12 weeks of age, lot II did not average more than 600 grams in any of the trials, whereas lot I averaged more than 700 grams in all the trials. The combined results of the three trials showed that lot I averaged 192.8 grams more than lot II. Based on the weight gained from the first day to the twelfth week, lot I was 25.04 per cent more efficient than lot II. In the analyses of variance when the sexes were separated, a highly significant difference between the weights of the lot means was obtained, indicating that the "Cono" lot converted feed into body weight more efficiently than the "kiskis" lot. The poor showing of the birds in lot II may be largely attributed to the relatively low

nutritive content of "kiskis" rice bran. Fraps [3] reported that rice hull has a low feeding value but shows no evidence of being injurious to animals.

Feed consumption. "Kiskis" rice bran was not so well relished by the chicks as "Cono" rice bran. Lot I consumed more feed than lot II (table 2), probably because there were more and bigger birds in lot I. Although this lot consumed more feed, it needed 1.71 kilograms less feed than lot II to put on a kilogram weanling weight. In returns above feed costs based on 100 chicks raised to weanling age, lot I gave ₱21.64 more than lot II. These results conclusively prove the superior feeding value of "Cono" rice bran as compared with that of unsieved "kiskis" rice bran.

Mortality. The highest mortality in both lots occurred during the second trial (table 3). Trial 3 had the lowest mortality rates. Most of the deaths in all the lots during the three trials were due to coccidiosis and roup.

In general, the mortality rate was higher in lot II than in lot I in all the trials. Apparently, the chicks in lot II, which received "kiskis" rice bran, developed weaker bodies and therefore had lower resistance to the common poultry diseases than the chicks in lot I.

Minor observations. In all the trials, the feathers of the chicks in lot I grew faster than those of the chicks in lot II. The birds in lot II had lighter color and pigmentation than those in lot I.

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[3] G. S. Fraps, *Texas Sta. Bull.*, 191 (1916). Cited in *U.S. Dept. Agric. Exper. Sta. Rec.*, 37, 363 (1917).

TABLE 1.—*Average weekly weight and number of New Hampshire chicks in the three trials*

AGE	LOT I		LOT II	
	No. of birds	Weight	No. of birds	Weight
		grams		*grams*
1 day	150	40.5	150	39.3
1 week	147	55.3	142	51.3
2 weeks	146	85.4	133	77.6
3 "	146	122.4	132	109.1
4 "	141	174.6	130	146.4
5 "	138	215.9	130	177.8
6 "	138	269.4	125	217.6
7 "	127	337.9	119	259.6
8 "	122	406.8	119	302.1
9 "	119	478.7	116	361.7
10 "	118	559.9	108	439.2
11 "	115	634.9	106	499.4
12 "	114	744.3±12.68	106	551.5±6.51
Relative efficiency, per cent ..		100.00		74.96

TABLE 2.—*Amount and cost of feed consumed and returns above feed costs (based on 100 chicks raised to 12 weeks of age)*

ITEM	LOT I				LOT II			
	Trial			Average	Trial			Average
	1	2	3		1	2	3	
Amount of feed consumed, kg.	426.2	378.1	296.0	366.7	399.3	377.5	312.6	363.1
Cost of feed consumed, pesos [a]	127.86	113.43	88.80	110.03	94.84	90.60	75.02	86.82
Average feed consumption of each bird, kg.	4.26	3.78	2.96	3.66	3.99	3.77	3.12	3.63
Weight of weanlings produced, kg.	77.40	74.51	71.34	74.41	50.97	58.16	56.29	55.14
Amount of feed required to grow a kilogram weanling weight, kg.	5.51	5.07	4.15	4.91	7.83	6.49	5.55	6.62
Cost of feed required to grow a kilogram weanling weight, pesos	1.65	1.52	1.25	1.47	1.88	1.56	1.33	1.59
Returns above feed costs, pesos [b]	65.64	72.83	89.55	76.01	32.59	54.80	65.71	54.37

[a] Cost of feed in lot I was ₱0.30 a kilogram; in lot II, ₱0.24.
[b] The price of a kilogram live weight was ₱2.50.

TABLE 3.—*Percentage of mortality*

ITEM	LOT I				LOT II			
	Trial			Average	Trial			Average
	1	2	3		1	2	3	
Number of birds at the start	50	50	50	50	50	50	50	50
Number of weanlings after 12 weeks	35	33	46	38	33	32	41	35.3
Number of chicks that died	15	17	4	12	17	18	9	14.7
Percentage of mortality	30.0	34.0	8.0	24.0	34.0	36.0	18.0	29.3

SELECTION AND PROPAGATION OF BLACK PEPPER[1]

BIENVENIDO A. ALMIRANTE

WITH THREE TEXT FIGURES

Of the 36 black pepper plants studied, numbers 3, 18, 19, 20, and 33 were selected as high yielders. Seeds from plant No. 3 started to germinate 15 days after sowing. The average percentage of germination was 31 per cent. Cuttings with seven nodes were the first to form roots, but those with five nodes had the greatest number of living plants at the end of one month.

Black pepper (*Piper nigrum* Linn. var. *trioicum* CDC) is a promising crop in the Philippines, and yet very little attention has been given to it. It is propagated commercially by cuttings and also by seeds in countries where cuttings are not available. The possible improvement of the crop by selection of high-yielding vines and their subsequent multiplication by seeds or cuttings should be considered.

Fig. 1.—Branches of pepper plant showing spikes ready for harvesting. (*Photographed by Photographic Division*).

[1] Central Experiment Station Contribution No. 1819. Thesis presented for graduation with the degree of Bachelor of Science in Agriculture from the College of Agriculture, October, 1954. Prepared in the Department of Agronomy under the direction of Associate Professor Pedro A. David and Assistant Professor Jose R. Mondoñedo.

This work was therefore conducted from November, 1952, to March, 1954, in the nursery and experimental fields of the Division of Perennial Crops, Department of Agronomy, College of Agriculture, Los Baños, Laguna.

MATERIALS AND METHODS

Thirty-six plants of black pepper collected from various sources were used in this study. The first harvest was begun in March, 1953. A spike was considered ready for harvesting when it had at least two red or yellow berries (fig. 1).

The harvested spikes from each plant were placed in separate paper bags. Then they were classified according to length. The berries were detached from the spikes and were counted. The developed berries were separated from the undeveloped ones and were returned to their respective containers.

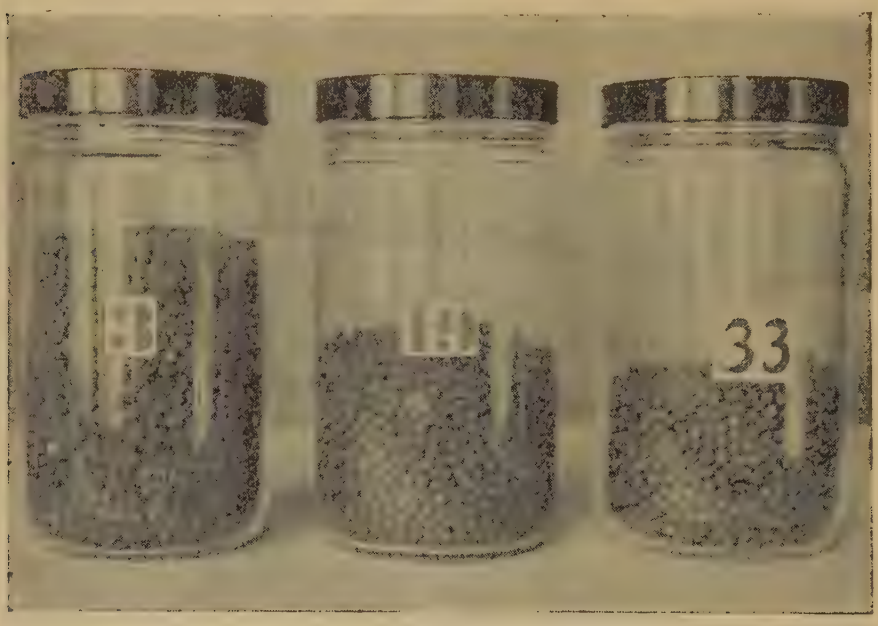

Fig. 2.—Dried peppercorns produced by plant numbers 3 (4.10 dl.), 19 (3.28 dl.), 33 (2.92 dl.). Note the airtight containers used for storing the dried peppercorns. (*Photographed by Photographic Division*).

The mature fruits were placed in a cheesecloth bag and dipped in boiling water for 15 seconds. They were dried in the sun for four to five days and were stored in air-tight containers (fig. 2).

The highest yielding pepper plants were selected on the basis of number of spikes and volume of dry peppercorns produced. The volume was measured with a 1-deciliter cup.

Two hundred fully matured and developed seeds were selected from plant No. 3. The seeds were first soaked in hot water for three days to remove their outer skin. They were air-dried in the shade and sown in rows in seedboxes filled with garden soil to which animal manure had been added. The percentage of germination was determined. The seedlings were watered frequently and were observed until the thirty-ninth day after sowing. At that age the seedlings had already four to five leaves, indicating that they were ready for field planting.

Fig. 3.—Samples of the different types of pepper cuttings: (a) seven nodes, (b) five nodes, and (c) three nodes. (*Photographed by the Photographic Division*).

From the highest yielding plant, cuttings with three, five, and seven nodes (fig. 3) were prepared with sharp pruning shears. The old leaves from the lower two nodes were removed before the cuttings were planted in pots of sterilized soil. Three replications of 30 cuttings each were planted. After planting, a starter solution of 50 pounds ammonium sulfate and 60 gallons of water was applied to the soil at the rate of 0.5 liter to a plant.

The cuttings were watered every day for the first three weeks and every other day thereafter.

RESULTS AND DISCUSSION

In the first crop the plants flowered in the first week of May and the fruits matured in the last week of August; in the second crop the plants flowered in the last week of November and the berries matured in the first week of March.

The average volume of dried peppercorns in each harvest ranged from 0.10 to 2.05 deciliters. The average weights also varied from 2.0 to 44.5 grams. This yield is very low when compared with the previous harvest in the same culture. David [2] reported that the black pepper culture in the College gave a minimum yield of 1 to 2 deciliters, or 20 to 40 grams of black peppercorns to a vine, in the first crop year, that is, three years after planting.

The mean yield in dry peppercorns of the 36 plants used in the study was 0.53 $\mp$ 0.07 deciliters; the coefficient of variation was 82.07 per cent. On this basis plants No. 3, 19, 33, 18, and 20, whose average yields of dry peppercorns were 2.05, 1.64, 1.46, 1.12, and 1.10 deciliters, respectively, were selected as the high-yielding plants. Of all of them plant No. 3 had the highest yield.

The harvested spikes had undeveloped berries and berries in different stages of maturity. The percentage of developed berries was considerably lower than the percentage of undeveloped ones (table 1).

David [3] noted canker, infection of eel worms, fungus hyphae on the vessels, and drying vines on the College black pepper culture. Vimuktanandana and Celino [4] reported anthracnose of pepper caused by *Colletotrichum nigrum* E & H as occurring in the College and its neighborhood. In the present study, only drying vines were observed among the plants. A species of Aspergillus [5] was present on some of the peppercorns. They were abundant on the stored peppercorns from plant No. 18 so that the desired black color was lost. Incomplete drying of the peppercorns may have enhanced the development of the fungus. *Stachyris nigrocapitata,* known as *pulanga* locally, was seen eating the fruits on the spikes as they turned red. The birds were frightened away by scarecrows.

The black pepper seeds sown on April 11, 1953, germinated on May 27, 1953 (table 2a). Germination started 15 days after sowing and was completed in 18 days. The average germination percentage of the two boxes was 31 per cent. The seedlings were found to have four to five leaves 21 days after germination. In the first week of growth, the average height of the seedlings in the two boxes was 3.6 centimeters; in the second week, 7.6 centimeters; and in the third week, 11.4 centimeters.

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[2] P. A. David, *UP Coll. of Agric. and Central Exper. Sta. Cir.,* 35 (1954).
[3] *Ibid.*
[4] Yan Yong Vimuktanandana and Martin S. Celino, *Philippine Agriculturist,* 29, 124 (1948).
[5] Identified by Dr. Faustino T. Orillo of the Department of Plant Pathology.

Cuttings with three, five, and seven nodes were planted on December 2, 1952. They started to form roots six to seven days after planting. Those with seven nodes were the first to form roots, and those with three nodes were the last. That seven-node cuttings formed roots earlier than the others may be attributed to the maturity of their nodes.

Of the three types of cuttings, those with five nodes had the greatest number of living plants at the end of one month, followed by those with seven nodes and those with three nodes (table 2b). Deaths among the seven-node cuttings were mostly due to stem breaking.

By the end of the third month, the roots of some cuttings, mostly of the seven-node ones, were seen coming out of the holes at the bottom of the pots.

When a pepper plantation is to be started from cuttings, therefore, it is advisable to use five-node cuttings, although the seven-node cuttings are better for rush work because they form roots earlier than the other two types.

TABLE 1.—*Number of spikes, average number of berries on the spikes, and average percentages of developed and undeveloped berries on the spikes*

PLANT NUMBER	NUMBER OF SPIKES	AVERAGE NUMBER OF BERRIES ON THE SPIKES		AVERAGE		
		Developed	Undeveloped	Total number of berries	Percentage developed berries	Percentage undeveloped berries
1	13	6.46	13.34	19.80	32.63	67.37
2	18	6.98	14.54	21.52	32.43	67.57
3	130	15.18	35.77	50.95	39.79	60.21
4	68	7.14	31.43	38.57	18.51	81.49
5	32	7.01	36.80	43.81	16.00	84.00
6	55	12.16	30.78	42.94	28.32	71.68
7	28	11.04	29.71	40.75	27.09	72.91
8	34	9.47	29.60	39.07	24.24	75.76
9	6	7.33	14.56	21.89	33.49	66.51
10	11	6.97	13.45	20.42	31.13	68.87
11	26	8.69	17.12	25.81	33.67	66.33
12	24	10.21	15.33	25.54	39.98	60.02
13	62	9.77	19.83	29.60	33.01	66.99
14	21	7.01	13.79	20.88	33.96	65.04
15	31	7.14	14.11	21.25	33.60	66.40
16	56	11.77	29.44	41.21	28.56	71.44
17	52	20.03	30.46	50.49	39.67	60.33
18	65	17.53	33.81	51.34	34.14	65.86
19	106	13.47	23.09	36.58	36.89	63.11
20	57	14.91	20.89	35.80	38.43	61.57
21	51	13.05	29.78	42.83	30.47	69.43
22	26	15.39	30.04	45.43	33.88	66.12
23	39	13.39	30.84	44.23	30.27	69.73
24	35	7.62	33.85	41.47	18.37	81.63
25	28	6.89	38.71	45.60	15.11	84.89
26	48	17.91	29.37	47.28	37.88	62.12
27	48	8.96	36.30	45.26	19.79	80.21
28	41	9.46	34.74	44.20	21.40	78.60
29	76	17.61	31.77	49.38	35.64	64.36
30	44	9.14	33.09	42.13	21.22	78.78
31	52	14.01	30.76	44.77	31.29	68.71
32	47	8.76	31.47	40.23	21.27	78.73
33	91	15.15	35.48	50.63	35.83	64.17
34	80	10.75	29.25	40.00	26.63	73.37
35	86	12.53	28.58	41.11	30.48	69.62
36	55	13.54	30.38	43.92	30.83	69.17

Mean average percentage of developed berries ..... 29.89 ∓ 0.08
Mean average number of developed berries ..... 12.31 ∓ 0.63

TABLE 2a.—*Dates of sowing and germination, percentage germination of seeds, and rate of growth of seedlings*

SEEDBOX NUMBER	DATE OF SOWING	DATE OF GERMINATION	GERMINATION PERIOD	TOTAL NUMBER OF SEEDS SOWN	NUMBER OF SEEDS GERMINATED	PERCENTAGE GERMINATION	AVERAGE HEIGHT OF SEEDLINGS		
							1st week	2nd week	3rd week
	1953	*1953*	*days*			*per cent*	*cm.*	*cm.*	*cm.*
1	April 11	May 27	16–17	100	28	38	3.7	7.4	11.3
2	April 11	May 27	15–18	100	34	34	3.5	7.7	11.5

TABLE 2b.—*Percentage germination of black pepper cuttings*

TYPE OF CUTTINGS	NUMBER OF CUTTINGS PLANTED			NUMBER OF LIVING CUTTINGS			PERCENTAGE GERMINATION			AVERAGE PERCENTAGE GERMINATION
	Rep. I	Rep. II	Rep. III	Rep. I	Rep. II	Rep. III	Rep. I	Rep. II	Rep. III	
							per cent	*per cent*	*per cent*	*per cent*
3 nodes	10	10	10	5	7	6	50	70	60	60
5 nodes	10	10	10	8	9	8	80	90	80	83.3
7 nodes	10	10	10	7	8	8	70	80	80	76.6

THE EFFECT OF VARYING AMOUNTS OF NITROGEN ON THE QUANTITY AND QUALITY OF JUTE FIBER [1]

BARTOLOMEO M. SALSALIDA

WITH THREE TEXT FIGURES

Treatment IV (120-24-36) produced the highest mean yield of fiber. Increasing the nitrogen increased the computed yield of fiber to a hectare. When the nitrogen was increased from 80 to 120 kilograms to a hectare, the percentage of fiber decreased slightly. Color, softness, and fineness of the fibers in all the plots were almost the same, but tensile strength and length varied. The best quality of fiber was produced by treatments III (80-24-36) and IV.

According to McMillan,[2] jute is an exhausting crop and requires manuring. Cattle manure plowed in before sowing at the rate of 3 to 4 tons to an acre gives good results, but potash fertilizers are better.

Cruz reported that ammonium sulfate fertilizer should be applied at the rate of 200 to 300 kilograms to a hectare when the saluyot plants are about two to three weeks old.[3]

This study was conducted in the Central Experiment Station and in the Departments of Agronomy and Soils, College of Agriculture, Los Baños, Laguna, from July, 1953, to February, 1954, to learn the effect of varying amounts of nitrogen applied with constant amounts of P_2O_5 and K_2O on the quantity and quality of jute fiber.

MATERIALS AND METHODS

An unfertilized clay loam field of 120 square meters (0.012 hectare) was used. It had previously been planted to ramie and had 0.07 per cent N, 13.1 ppm. P, and 93 ppm. K. when analyzed in the Department of Soils. The land was divided into five blocks, each with four plots numbered at random. The plots were 6 square meters each and had 1½-meter paths between them. Canals were made in the paths to prevent rain water from washing away the fertilizer from one plot to another.

Seeds of the green-stemmed *Corchorus capsularis* Linn. with an average viability of 95 per cent were hand-drilled on September 12, 1953. They were planted in shallow furrows, 20 centimeters apart

[1] Central Experiment Station Contribution No. 1820. Thesis presented for graduation with the degree of Bachelor of Science in Agriculture from the College of Agriculture, October, 1954. Prepared in the Department of Agronomy under the direction of Associate Professor Pedro A. David and in the Department of Soils under the direction of Associate Professor Nicolas L. Galvez.

[2] H. F. McMillan, "Tropical Planting and Gardening," The McMillan and Co., London, 1949, 5th ed., 560 pp.

[3] E. E. Cruz, *Plant Indus. Digest*, 2, 13 (1948).

between rows, at the rate of 7.68 grams to a plot (2 m. × 3 m.) or 12 kilograms to a hectare.

Ammonium sulfate (21-0-0), ammonium phosphate (16-20-0), and potassium sulfate (0-0-46) were used at the following rates of nitrogen, phosphorus, and potassium:

Plot 1	control
Plot 2	40-24-36 kg. to a hectare
Plot 3	80-24-36 " " " "
Plot 4	120-24-36 " " " "

Phosphate and potash were added to maintain the approximate N-P-K ratio for jute.

Plot 2 received 72 grams of ammonium phosphate, 47 grams of potassium sulfate, and 59 grams of ammonium sulfate. Plot 3 received 174 grams of ammonium sulfate and plot 4 received 288 grams; both plots received the same amounts of potassium sulfate and ammonium phosphate.

Fifteen plots were equally treated with a mixture of 1.08 kilograms of $(NH_4)_3\ PO_4$ and .705 kilogram of K_2SO_4. All the plots, except the control, were side-dressed with 119 grams of $(NH_4)_3\ PO_4$ and K_2SO_4 mixture three weeks after planting. The plants were thinned 5 centimeters apart. Five days after the application of the $(NH_4)_3\ PO_4$ and K_2SO_4 mixture, the computed amounts of $(NH_4)_2SO_4$ were added to each plot. The plots were weeded and cultivated three weeks after planting and before the fertilizers were applied. Subsequent weeding and cultivation were not necessary as the plants were by then taller than the weeds. The plants were, however, hilled up when they were blown down by a strong wind and three successive heavy rains in October, 1953. No pests and diseases were found attacking the plants.

At harvest, the branches of five plants selected at random from each plot were counted and their heights were measured. Four harvests were made as the plants in each block did not flower at the same time. The leaves of the plants were removed and the fresh stalks were tied into bundles, labeled, and weighed. The stalks were then retted, and 12 days later the fibers were separated from the pith, washed thoroughly in running water, dried, and weighed.

The tensile strength of the fibers was determined with a Scott Tester IP-2 Tensilgraph machine and expressed in breaking length according to the formula of Botkin, Shires, and Smith.[4]

RESULTS AND DISCUSSION

Growth of plants. There was a marked difference in growth among the plants (figs. 1 and 2). An increase in the amount of nitrogen increased the height of the plants rapidly and produced broad, dark-green leaves. The control plants had the poorest growth.

[4] C. W. Botkin, L. B. Shires, and E. C. Smith, *New Mexico Agric. Exper. Sta. Bull.*, 300 (1943).

Fig. 1.—Upper panel, representative control plot showing the growth of jute plants 41 days after the first application of fertilizers. Lower panel, representative treatment II (40-24-36) plot showing the growth of jute plants 41 days after the first application of fertilizers. (*Photographed by Dr. Julian Banzon of the Photographic Division.*)

Fig. 2.—Upper panel, representative treatment III (80-24-36) plot showing the growth of jute plants 41 days after the first application of fertilizers. Lower panel, representative treatment IV (120-24-36) plot showing the growth of jute plants 41 days after the first application of fertilizers. (*Photographed by Dr. Julian Banzon of the Photographic Division.*)

They were stunted and had small, short stems and narrow, yellowish leaves (fig. 2, lower panel).

Height of plants. At harvest the plants in treatment IV were taller than those in treatment III (table 1).

Number of branches. Jute plants that have few branches or none at all produce high-quality fibers. The mean number of branches in treatment IV was 4.16; in treatment III, 3.76; in treatment II, 3.48; and in treatment I, 2.96.

Maturity period. The mean days till maturity of treatment IV was 92.8; of treatment III, 88.6; of treatment II, 86.8; and of treatment I (control), 86.4. The plants that received the largest amount of nitrogen (treatment IV) matured last because the nitrogen delayed maturity and prolonged the period of growth and development of the parts of the plants, particularly the stems and leaves.

Yield of fibers. Table 2 shows the mean yields of dry fiber obtained from 1 square meter of each plot and the computed yields of fiber to a hectare. The yield in this study was comparatively lower than that obtained by Cruz (1948) probably because the planting was out of season. The actual yield of fiber to a hectare was 20 piculs, and the highest computed yield to a hectare was only 17.5 piculs. Planting should have started in June, 1953, but was delayed until September 12, 1953, because of unavailability of materials.

Percentage fiber extraction. The percentages of extraction of fiber of the different treatments were significantly higher than those of the control (table 3).

Quality of fibers. Fibers obtained from the different treatments were more or less the same in softness and color, but not in length and tensile strength. The fibers were brownish, soft, and fine. Those from treatments III and IV were the best in tensile strength and length.

The differences in length of fiber were significant (table 4 and fig. 3). In mean tensile strength the difference between treatments I and II was highly significant (table 5). The difference between treatments II and III was insignificant, but the differences between treatments II and IV, III and IV, and I and IV were significant.

Fig. 3.—Amounts and lengths of fibers in the treated and control plots compared. (*Photographed by Dr. Julian Banzon of the Photographic Division.*)

TABLE 1.—*Height of plants in centimeters as influenced by varying amounts of nitrogen*

TREATMENT	REPLICATION					TOTAL	MEAN
	I	II	III	IV	V		
Control	131.2	76.2	104.5	82.3	117.1		
	120.0	76.1	122.5	82.5	110.2		
	102.1	80.5	131.1	96.9	96.0		
	121.5	70.1	132.0	79.5	104.5		
	113.4	74.0	135.2	96.8	102.0		
Total	588.2	376.9	625.3	438.0	529.8	2,558.2	102.33
40–24–36	153.8	111.3	136.0	110.5	121.9		
	160.8	112.1	131.2	107.6	120.5		
	175.1	116.0	125.9	131.7	137.3		
	145.2	116.9	144.3	110.5	123.7		
	157.5	111.1	139.0	148.9	108.2		
Total	792.4	567.4	676.4	609.2	611.6	3,257.0	130.28
80–24–36	154.2	135.5	171.0	127.4	136.7		
	162.6	131.2	157.6	122.1	144.5		
	179.9	154.1	167.9	126.7	137.1		
	144.1	134.5	154.5	125.3	147.8		
	157.0	121.7	180.0	130.8	139.0		
Total	797.8	677.0	831.0	632.3	705.1	3,643.2	145.73
120–24–36	173.2	154.1	169.2	145.5	146.3		
	177.0	129.2	179.5	129.6	147.1		
	143.5	145.5	156.1	170.8	151.1		
	166.2	132.8	169.9	136.2	152.5		
	149.8	139.9	170.2	138.4	156.8		
Total	809.7	701.5	844.9	720.5	763.8	3,840.4	153.62
Total	2,988.1	2,322.8	2,977.6	2,400.0	2,610.3	13,298.8	

Analysis of variance

SOURCE OF VARIANCE	DF	SUM OF SQUARES	MEAN SQUARE	COMPUTED F-VALUE	TABULAR F-VALUE	
					5%	1%
Replications	4	19,614.66	4,903.67	16.67	3.26	5.41
Treatments	3	38,379.78	12,793.26	43.48 [a]	3.49	5.95
Replications × treatments	12	3,530.52	294.21			
Sampling error	80	8,677.35	108.47			
Total	99	70,202.31				

[a] L.S.M.D. = 10.57

TABLE 2.—*Mean yield in grams as influenced by varying amounts of nitrogen*

TREATMENT	REPLICATION					TOTAL	MEAN
	I	II	III	IV	V		
Control	43.3 43.6	29.3 28.2	46.7 46.8	34.3 36.3	30.8 30.3		
Total	86.9	57.5	93.5	70.6	61.1	369.6	36.96
40–24–36	78.4 76.6	65.7 67.6	98.0 100.0	68.3 68.6	77.0 78.1		
Total	155.0	133.3	198.0	136.8	155.1	778.3	77.83
80–24–36	105.3 104.7	86.1 84.4	96.6 96.4	97.9 97.6	100.0 105.5		
Total	210.0	170.5	193.0	195.5	205.5	974.5	97.45
120–24–36	116.7 116.8	90.4 89.6	95.4 97.3	105.5 107.5	145.2 143.3		
Total	233.5	180.0	192.7	213.0	288.5	1,107.7	110.77
Total	685.4	541.3	677.2	616.0	710.2	3,230.1	

Analysis of variance

SOURCE OF VARIANCE	DF	SUM OF SQUARES	MEAN SQUARE	COMPUTED F-VALUE	TABULAR F-VALUE	
					5%	1%
Replications	4	2,313.69	578.42	1.92	3.26	5.41
Treatments	3	31,061.81	10,353.94	34.46 [a]	3.49	5.95
Replications × treatments	12	3,605.72	300.48			
Sampling error	20	31.60	1.58			
Total	39	37,012.82				

[a] L.S.M.D. = 16.89

TABLE 3.—*Percentage fiber extraction as influenced by varying amounts of nitrogen*

TREATMENT	REPLICATION					TOTAL	MEAN
	I	II	III	IV	V		
Control	1.546 1.453	1.724 1.880	1.863 1.872	2.144 1.911	2.200 2.164		
Total	2.999	3.604	3.735	4.055	4.364	18.757	1.876
40–24–36	2.119 2.303	2.433 2.331	2.579 2.380	2.627 2.638	2.567 2.603		
Total	4.422	4.764	4.959	5.265	5.170	24.580	2.458
80–24–36	2.513 2.755	2.327 2.403	2.542 2.537	2.797 2.789	2.560 2.510		
Total	5.268	4.730	5.079	5.586	5.070	25.733	2.573
120–24–36	2.836 2.336	2.205 2.287	1.987 1.946	2.344 2.560	3.300 3.256		
Total	4.972	4.492	3.933	4.904	6.556	24.857	2.485
Total	17.661	17.590	17.706	19.810	21.160	93.927	

Analysis of variance

SOURCE OF VARIANCE	DF	SUM OF SQUARES	MEAN SQUARE	COMPUTED F-VALUE	TABULAR F-VALUE	
					5%	1%
Replications	4	1.32	0.33	2.54	3.26	5.41
Treatments	3	3.05	1.02	7.85 [a]	3.49	5.95
Replications × treatments	12	1.55	0.13			
Sampling error	20	0.19	0.0095			
Total	39	6.11				

[a] L.S.M.D. = 0.35

TABLE 4.—*Length of fibers in centimeters as influenced by varying amounts of nitrogen*

TREATMENT	REPLICATION					TOTAL	MEAN
	I	II	III	IV	V		
Control	61.3 62.7	41.2 42.3	58.0 56.0	54.0 57.0	52.5 51.5		
Total	124.0	83.5	114.0	111.0	104.0	536.5	53.7
40–24–36	86.4 87.1	68.0 69.0	82.0 78.0	66.0 62.0	67.0 71.0		
Total	173.5	137.0	160.0	128.0	138.0	736.5	73.7
80–24–36	83.0 87.0	74.0 76.0	85.0 87.0	75.0 75.0	76.2 75.8		
Total	170.0	150.0	172.0	150.0	152.0	794.0	79.4
120–24–36	82.7 85.3	73.0 77.0	84.6 87.4	77.7 73.3	84.5 83.5		
Total	168.0	180.0	172.0	153.0	168.0	811.0	81.1
Total	635.5	520.5	618.0	542.0	562.0	2,878.0	

Analysis of variance

SOURCE OF VARIANCE	DF	SUM OF SQUARES	MEAN SQUARE	COMPUTED F-VALUE	TABULAR F-VALUE	
					5%	1%
Replications	4	1,216.96	304.24	9.23	3.26	5.41
Treatments	3	4,770.05	1,590.02	48.23	3.49	5.95
Replications × treatments	12	395.64	32.97			
Sampling error	20	64.09	3.20			
Total	39	6,446.74				

L.S.M.D. = 5.58

TABLE 5.—*Tensile strength in kilometers as influenced by varying amounts of nitrogen*

TREATMENT	REPLICATION					TOTAL	MEAN
	I	II	III	IV	V		
	13.75	23.33	25.63	23.75	20.00		
	18.00	16.67	30.00	15.00	15.00		
	17.22	21.25	20.00	15.00	25.00		
	18.20	23.75	22.50	20.03	22.50		
Control	25.63	14.33	23.67	20.00	20.00		
		18.13	28.00	24.37	20.00		
	33.70	18.00	24.38	22.00	23.00		
	26.70	81.00	25.00	16.25	26.00		
	27.00						
	29.38	25.00	20.40	23.00	18.33		
	32.50	23.00	22.10	28.75	21.67		
Total	242.08	204.46	241.68	208.15	211.50	1,107.87	22.16
	22.50	21.66	46.67	30.45	48.33		
	33.00	24.17	36.00	28.33	27.50		
	42.50	24.10	30.00	28.10	20.00		
	30.83	26.70	35.63	26.67	30.00		
	29.00	37.50	31.67	30.10	32.50		
40–24–36	50.00	26.67	27.67	35.00	25.82		
	31.25	35.00	33.00	36.10	33.33		
	36.00	22.50	24.00	31.67	22.00		
	35.00	20.00	29.25	30.00	22.25		
	31.33	35.00	30.25	20.00	30.00		
Total	341.41	273.30	324.14	296.42	303.73	1,539.00	30.78
	37.50	23.33	46.67	37.50	40.00		
	45.00	21.67	20.67	20.00	50.00		
	31.25	27.50	35.00	25.00	38.75		
	34.17	23.75	31.67	20.00	31.87		
80–24–36	37.50	28.00	24.00	30.10	20.00		
	36.66	23.33	26.67	50.67	25.00		
	41.67	25.00	29.00	30.67	27.33		
	35.00	24.00	28.50	36.67	27.50		
	49.70	26.67	35.00	31.27	26.00		
	20.00	26.00	30.50	20.00	26.33		
Total	368.45	249.25	307.68	301.88	312.78	1,540.04	30.80
	30.00	30.00	30.00	31.00	24.00		
	30.00	28.50	30.00	26.85	25.00		
	30.00	26.67	25.00	25.00	25.00		
	42.50	31.67	35.00	30.00	23.33		
120–24–36	25.00	26.25	26.67	36.67	32.50		
	25.00	23.30	35.00	30.00	32.50		
	32.50	23.75	26.25	30.00	26.33		
	31.25	25.00	20.40	23.75	31.67		
	28.75	26.67	25.00	26.67	26.67		
	27.50	31.67	31.67	25.00	22.00		
Total	302.50	273.48	284.99	284.94	269.00	1,414.91	28.30
Total	1,254.44	1,000.49	1,158.49	1,091.39	1,097.01	5,601.82	

Analysis of variance

SOURCE OF VARIANCE	DF	SUM OF SQUARES	MEAN SQUARE	COMPUTED F-VALUE	TABULAR F-VALUE	
					5%	1%
Replications	4	879.62	219.90	6.45	3.26	5.41
Treatments	3	2,489.87	829.96	24.36	3.49	5.95
Pooled error	192	6,540.77	34.07			
Total	199	9,910.26				

L.S.M.D. based on pooled error = 2.55

THE VARIABILITY OF SEVEN ABACÁ VARIETIES[1]

CONRADO N. BALIGUAS

WITH FIVE TEXT FIGURES

Of the seven varieties studied, Itom was fairly good in stooling habit, tensile strength, and yield of fiber. It had the highest number of stools. Pula showed a marked advantage in tensile strength over the other varieties. The lowest amount of fiber was produced by Binagacay, and the highest by Binukid. Binagacay, Itom, and Pula were hard to strip, whereas Binukid, Bongolanon, Puti, and Bulao were easy to strip. It is suggested that the three promising varieties, Itom, Bulao, and Puti, be further studied.

In 1919, the Department of Agronomy initiated the growing of abacá seedlings for the production of new varieties, but the work did not go beyond the demonstration of variability among young seedling plants.[2]

Ricahuerta [3] studied seven varieties of abacá seedlings and found Bulao, Puti, Binukid, and Itom to be the most promising as to ger-

Fig. 1.—General view of the different clones of abacá in the field 10 months after planting.

[1] Central Experiment Station Contribution No. 1821. Thesis presented for graduation with the degree of Bachelor of Science in Agriculture from the College of Agriculture, October, 1954. Prepared in the Department of Agronomy under the direction of Dr. Pedro A. David.

[2] N. B. Mendiola, *Philippine Agric. Rev.*, **16**, 85 (1923).

[3] J. R. Ricahuerta, *Philippine Agriculturist*, 35, 504 (1952).

Fig. 2.—Flower bud and fruit of abacá. (*Photographed by Olive's Studio*).

mination, height, number of leaves, and number of roots of seedling plants.

This study was made in the experimental field of the Fiber and Oil Division, Department of Agronomy, College of Agriculture and Central Experiment Station, Los Baños, Laguna, from December, 1952, to August, 1953, to determine and compare the stooling habit,

tensile strength, amount of fiber produced, and suitability to stripping of the seven varieties tested by Ricahuerta.

MATERIALS AND METHODS

The field of 252 square meters was plowed twice with a native plow and harrowed after each plowing. Holes 3 meters apart were dug with a post-hole digger.

Four clones each of varieties Binagacay, Binukid, Bongolanon, Bulao, Itom, Pula, and Puti were planted at random. The field was weeded and cultivated with a native plow six times until the plants were 10 months old (fig. 1). For 10 months thereafter, no cultivation was done except occasional weeding and cutting of dried leaves.

Fig. 3.—Preparation of tuxies from abacá stalks. (*Photographed by Olive's Studio*).

The abacá stalks were considered ready for harvest at the first appearance of inflorescence (fig. 2). Four stalks each of the seven varieties were harvested, cleaned, labeled, and weighed. Tuxies (fig. 3) were prepared from the stalks, and the fibers were extracted with a *hand-hagutan* (fig. 4). The cleaned fiber was hung to dry (fig. 5) and its dry weight was recorded.

Four samples, each consisting of three single-fiber strands selected at random from each variety, were tested in the Scott Tester

Fig. 4.—Extraction of fiber from a leaf sheath of abacá with a native *kandhagutan* showing (k) knife, (t) tuxy, (ft) foot treadle, and (w) weight. (*Photographed by Olive's Studio*).

Fig. 5.—Drying of abacá fiber. (*Photographed by Olive's Studio*).

IP-2 Tensilgraph machine.[4] The tensile strength expressed in breaking length was then computed in terms of kilometers according to the formula of Botkin, Shires, and Smith.[5]

RESULTS AND DISCUSSION

Number of stools. Binagacay gave the lowest mean number of stools, and Itom, the highest (table 1). The differences in mean number of stools of the seven varieties varied significantly.

Tensile strength. The tensile strength of the fibers from the middle section of the seventh leaf sheath of each plant was determined. Puti and Binukid had practically the same value (table 2). Pula gave the highest mean tensile strength, and Binagacay gave the lowest. The value of F was statistically insignificant, however, and it is suggested that more *d.f.* be used in subsequent tests for tensile strength.

Amount of fiber. The weight of dry fiber extracted from each plant of the seven varieties ranged from 48.2 grams for Binagacay to 87.4 grams for Binukid (table 3). Statistical treatment showed significant differences. Binukid and Itom outyielded the other varieties.

Pests and diseases.[6] Five months after transplanting, varieties Binukid and Binagacay were attacked by stem rot caused by *Helminthosporium torulosum* (Syd.) Ashby. Seven months later one of the plants in a Binukid block showed symptoms of bunchy-top disease caused by *Marmor abacá* Holmes. The plant was dug, chopped, and buried, and the area it occupied was sprinkled with 500 grams of ordinary soap diluted in 20 liters of water. Giant African snails fed upon the leaves of the young abacá plants, and banana leaf rollers made rolls and cuts on the blades of the leaves.

Age of the plants at harvest. The plants were considered mature at the emergence of inflorescence. Variations within varieties were not as wide as variations between varieties. Binagacay and Binukid matured 18 months after transplanting; Bongolanon and Bulao, 19 months; and Itom, Pula, and Puti, 20 months.

Suitability to stripping. Binagacay, Itom, and Pula were hard to strip; Binukid, Bongolanon, Puti, and Bulao were easy to strip.

[4] *Ibid.*

[5] C. W. Botkin, L. B. Shires, and C. Smith, *New Mexico Agric. Exper. Sta. Bull.*, 300 (1943).

[6] The diseases mentioned in this paper were identified by Dr. F. T. Orillo of the Department of Plant Pathology.

TABLE 1.—*Number of stools of the seven varieties*

SEEDLING VARIETY	BLOCK				TOTAL	MEAN
	I	II	III	IV		
Binagacay	6	7	7	12	32	8
Binukid	10	23	9	13 [a]	55	13.8
Bongolanon	16	17	13	16	62	15.5
Bulao	20	25	18	19	82	20.5
Itom	29	24	17	24	94	23.5
Pula	18	28	13	23	82	20.5
Puti	33	21	12	9	75	18.8
Total	132	145	89	116	482	
Mean	18.9	20.7	12.7	16.6		

[a] Missing plot corrected.

Analysis of variance

SOURCE OF VARIANCE	DF	SUM OF SQUARES	MEAN SQUARE	COMPUTED F-VALUE	TABULAR F-VALUE	
					5%	1%
Blocks	3	249.28	83.10	2.94	3.20	5.18
Varieties	6	653.22	108.88	3.85	2.70	4.10
Residual error	17	480.21	28.25			
Total	26	1,382.71	53.18			

L.S.M.D. = 7.81

TABLE 2.—*Tensile strength in kilometers of the seven varieties*

SEEDLING VARIETY	BLOCK				TOTAL	MEAN
	I	II	III	IV		
Binagacay	65.75	73.67	76.55	67.08	283.05	70.76
Binukid	78.65	87.76	85.42	88.02 [a]	339.85	84.96
Bongolanon	83.91	97.23	96.71	91.83	369.68	92.42
Bulao	69.51	72.38	91.29	83.20	316.38	79.10
Itom	80.05	76.12	99.30	90.34	345.81	86.45
Pula	97.36	86.18	119.52	86.62	389.68	97.42
Puti	52.96	83.96	91.51	110.05	338.48	84.62
Total	528.19	577.30	660.30	617.14	2,382.93	
Mean	75.46	82.47	94.33	88.16		

[a] Missing plot corrected.

Analysis of variance

SOURCE OF VARIANCE	DF	SUM OF SQUARES	MEAN SQUARE	COMPUTED F-VALUE	TABULAR F-VALUE	
					5%	1%
Blocks	3	1,361.28	453.76	3.96	3.20	5.18
Varieties	6	1,796.27	299.38	2.61	2.70	4.10
Residual error	17	1,949.69	114.96			
Total	26	5,107.24	196.43			

TABLE 3.—*Amount of fiber in grams produced by the seven varieties*

SEEDLING VARIETY	BLOCK				TOTAL	MEAN
	I	II	III	IV		
Binagacay	32.2	47.3	58.9	53.5	192.9	48.2
Binukid	80.2	59.8	116.5	92.9 [a]	349.4	87.4
Bongolanon	49.2	57.6	56.4	58.5	221.7	55.4
Bulao	35.9	69.0	76.0	98.2	279.1	69.8
Itom	78.0	80.0	93.3	80.9	332.2	83.1
Pula	79.5	67.4	61.0	59.6	267.5	66.9
Puti	89.4	76.6	60.2	84.3	310.5	77.6
Total	445.4	457.7	522.3	527.9	1,953.3	
Mean	63.6	65.4	74.6	75.4		69.76

[a] Missing plot corrected.

Analysis of variance

SOURCE OF VARIANCE	DF	SUM OF SQUARES	MEAN SQUARE	COMPUTED F-VALUE	TABULAR F-VALUE	
					5%	1%
Blocks	3	785.85	261.95	1.06	3.20	5.18
Varieties	6	4,901.85	816.97	3.31	2.70	4.10
Residual error	17	4,201.41	247.14			
Total	26	9,889.11	380.35			

L.S.M.D. = 25.11

A PRELIMINARY STUDY ON THE EFFECT OF TOPPING EGGPLANT [1]

P. S. Fajardo

No marked differences were observed in the yield and size of fruit of the original plants and the topped ones. The topped plants flowered and set fruit in less time than the original plants. They also suffered much less from bacterial wilt, but they were severely attacked by termites.

Eggplant is grown extensively in the Philippines, but the supply is not sufficient to meet the demand. In raising the crop, the common practice is to grow the seedlings in the seedbed and transplant them to the field. Although eggplant is considered a biennial plant, it is grown commercially just once a year. If another crop could be produced from the original plants by topping them, the problem of securing seeds, growing the seedlings, and preparing the field could be laid aside for the moment. Will the grower get a good harvest? This study was undertaken to answer this question.

GROWING THE SEEDLINGS

Seeds of the Native Long Purple variety of eggplant were obtained from the Bureau of Agricultural Extension. They were sown thinly and evenly in a seedbox on September 2, 1953. To hasten germination a clean, wet gunny sack was spread over the seedbox. Watering was done over the sack whenever necessary. The seeds germinated after three days. Eighteen days after germination, the seedlings were transplanted to a pricking bed. There they were fertilized with ammonium sulfate at a concentration of 100 grams of the fertilizer to every 5-gallon can of water. Two applications were made—the first, one week after pricking and the second, one week before transplanting. The seedlings were kept in the pricking bed for 29 days.

PREPARING THE FIELD AND TRANSPLANTING THE SEEDLINGS

Just after the seeds had been sown in the seedbox, a backyard garden of Los Baños clay loam was prepared by digging it deeply and uniformly with a spading fork and pulverizing the soil thoroughly with a rake. The field was dug twice and pulverized after each digging. The soil was mixed thoroughly. The rows and hills were laid 1 meter apart each way. Five rows were laid with 10 holes in each row.

On October 23, 1953, or 50 days after sowing, the seedlings were transplanted. They were first watered to facilitate pulling and to minimize the destruction of roots. The seedlings were selected on the basis of uniformity of growth.

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[1] General Contribution No. 872.

Ten days after transplanting, the plants were fertilized with ammonium sulfate at the rate of 300 kilograms a hectare. Each plant received 30 grams of the fertilizer in a ring around its base. The fertilizer was covered by cultivating the plants. Weeding was done occasionally.

On December 8, 1953, the plants showed signs of flowering. The first harvest was made 21 days after flower setting. Subsequent harvests were made at three-day intervals for four months.

TOPPING THE PLANTS

On May 1, 1953, the plants, which were now eight months old, were topped. The top of each plant was cut with a pair of pruning shears, leaving a stump about twenty-five centimeters high. The plants were then weeded thoroughly. The next day ammonium sulfate at the rate of 30 grams to a hill was spread uniformly around each plant. Hilling-up was done to cover the fertilizer.

The plants grew new tops, and on July 9, 1954, or 69 days after topping, they showed signs of flowering. They were first harvested on July 28, 1954, or 19 days after flower setting. The next harvests were made at three-day intervals for about four months.

COMPARING THE YIELDS

The important results of the experiment may be seen in the following table:

ITEM	ORIGINAL PLANTS	TOPPED PLANTS
Average number of fruits to a plant	19.09	20.80
Average length of fruit in centimeters	21.72	20.55
Average diameter of fruit in centimeters	3.37	3.11
Percentage of mortality due to bacterial wilt	30.00	13.79
Percentage of mortality due to termites	—	17.14
Age of flowering in days	97 [a]	69 [b]

[a] After sowing.
[b] After topping.

The differences in yield to a plant and size to a fruit of the original and the topped plants were not marked, but the differences in mortality due to bacterial wilt were. The low percentage of mortality from the disease among the topped plants may be attributed to the law of natural selection.

One important observation was that the topped plants were attacked by termites. The attack, which affected about 17.14 per cent of the whole population, was noticed one day after topping. The sap oozing out from the cuts probably attracted the termites. None of the affected plants survived.

Fruit setting was observed 21 days after flower setting in the original plants and 19 days after flower setting in the topped plants.

The results show that although there were no marked differences in yield and in size of fruit between the original and the topped plants, certain benefits may be derived from topping. Economy of time, effort, and expense is achieved by eliminating such processes as securing seeds for planting, growing and caring for the seedlings, preparing the field, and transplanting.

COLLEGE AND ALUMNI NOTES

The solution of agricultural problems through research in areas where these problems exist was the subject of the speech of Dr. C. E. F. Guterman, director of the agricultural experiment station of Cornell University, at a convocation on January 27. Dr. Guterman was in the Philippines for three weeks to review work being done to implement the UP College of Agriculture-Cornell University technical assistance contract which was signed in 1952.

A Livestock Day was held at the Animal Husbandry compound on February 5. Dean Uichanco welcomed the guests, after which Dr. Villegas gave an informal preliminary lecture on the livestock industry. Dairy and meat products, tethers, knots, and animal breeds were displayed in the judging shed. Milking, cheese making, throwing down of calves, castration, and breeding were demonstrated. In the afternoon an open forum was conducted by Dr. Manresa as moderator.

An important feature of the field day was the signing of a ten-year project agreement between the College and the Bureaus of Animal Industry and Agricultural Extension for the improvement of dairy cattle by crossbreeding. The cooperating agencies will work with Sahiwal, Brown Swiss, and native breeds of cattle for milk production, adaptability, and possible formation of a new breed of dairy cattle.

Cornell and College personnel exchanged parties at which Dr. and Mrs. C. E. F. Guterman were honorees. The Cornell party held on the second of February featured a short musical program and dancing. The College party held on the seventh saw a "rigodon de honor" of the Filipino faculty and native dances and songs.

A feed conference was held on March 12 to acquaint feed producers, mixers, and dealers with recent research findings in livestock and poultry feeding and to enable them to work closely with the College. Common commercial poultry feeds, antibiotics in swine and poultry rations, corn gluten feed for dairy cows, copra meal and ipil-ipil in poultry rations, and digestion studies on forages were discussed.

The library building and 32 other buildings constructed with FOA-PHILCUSA funds were inaugurated on the afternoon of March 3 at a short literary musical program. The invocation by Fr. Roman Baes was followed by opening remarks by Assistant Dean Santos. Dean Leland E. Call gave the inaugural address. He was introduced by Dean Uichanco.

Nicanor Teodoro, '15, now operates a private consulting agency on agriculture in Manila.

Manuel R. Monsalud, '31, has resigned as general farm manager of the Cojuangco haciendas in Central Luzon to accept the position of chief chemist with the Bureau of Forestry.

Instructors Laureano O. Bondoc, '49, and Antonio D. Bustrillos, '48, both FOA trainees, arrived recently from Cornell University after a year's study. Bondoc studied pomological culture and Bustrillos specialized in electron microscopy in relation to virus research.

Five hundred zoology students made the traditional trip to Dalahican, Quezon, to observe and collect marine animals. With the students were Dr. S. M. Cendaña, Misses Quiaoit, Salazar, and Samson, and Messrs. Peña, Cariaso, Plurad, and Madamba.

Margaret Helburn of Cambridge, Meredith C. Wilson of Washington, and Edgar and Grace Vesta of Bangkok were accompanied by Harper S. Johnson of FOA Manila on a guided tour of the College on January 19.

The Philippine Country Life Association motored to the Central Luzon Agricultural College on January 22. The group of 80 was headed by Fernando Bernardo, PCLA president, and Miss D. P. Barile, adviser.

Dr. C. D. Kearl lectured to agricultural economics students of the Far Eastern University on January 23. The students were accompanied to the College by Prof. Jose Dacanay.

The January faculty social was held at the faculty clubhouse on the evening of the 27th. Host at the affair was the Animal Husbandry Department.

The 230th scientific meeting of the Los Baños Biological Club was held on January 28 at the chemistry lecture hall. Dr. C. E. F. Guterman spoke on agricultural experiment station research in the United States.

A workshop on student government leadership sponsored by the Philippine Association of Colleges and Universities was held in the College from January 29 to 30.

Dr. Amando M. Dalisay of the National Economic Council was lecturer at a seminar of the Department of Agricultural Economics on February 5. He spoke on "the rice crises and the policy on price supports: basic problems of agricultural marketing in the Philippines."

The College is appealing to its alumni for donation of the following issues of *The Philippine Agriculturist* to complete its collection in the College Library.

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ERRATA

Page 21, caption of picture should read,

"Lower panel, lowland rice plant, variety Thailand, sprayed with 1000 ppm. 2,4-D at the rate of 5 gal./1000 sq. ft. at one month of age. Note the almost 90° angle between the leaf blade and leaf sheath of the sprayed plant as compared with the almost 180° of the untreated plant in the upper panel. Planted Dec. 8, 1952; sprayed Jan. 8, 1953; photographed Jan. 13, 1953."

Page 198, line 14 from top, for "3.7" read "1.7".

40/1.P.C.